101

Syllabus

TECHNOLOGY FOR HIGHER EDUCATION

OCTOBER 2002 • VOLUME 16, NO. 3

A 101communications Publication

Wireless on Campus

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EDITOR'S NOTE

Mary Grush, Editor

While wireless access to the campus network is becoming more commonplace, it's usually available only in selected areas. A few institutions, like Dartmouth College, have made the commitment to provide wireless access throughout the campus. In our lead feature, "Campus-Wide Wireless: Mobility and Convergence" (page 14), we interview Dartmouth College computing director Larry Levine, who has seen wireless access light up the entire campus within one year. For Levine, a wireless overlay is now just another aspect of the campus network: "In my view, as long as you have a network, that should mean wireless as well as wired."

But wireless technology is still new to many. Just what is the difference between 802.11a and 802.11b? In "The Brave New World of Wireless Technologies" (page 19), Jerry Boerner provides some basic knowledge for educators.

For most wireless users on campus, the big draw seems to be the convenience and flexibility of anywhere access, along with more spontaneous communications, rather than any particular application for education. But a few faculty have really taken to the technology and have identified some direct benefits for teaching and learning. At Virginia Tech, Kevin Oliver, Catherine Eckel, and Sheryl Ball are among the innovators of "Wireless Interactive Teaching Simulations" (page 33). The team uses handheld devices with wireless access in large lecture halls, increasing student engagement with the subject matter as it is being presented to them.

Though there are some issues about security, wireless is a fairly robust technology—straightforword for users and reliable. But we are still on the beginning side of the adoption curve in higher education. There is plenty of potential in this technology for teaching and administration—everything from classroom management to providing network service for temporary locations. But it could be the personal productivity gains that drive further implementation. Particularly, as students become more mobile, and handheld computing appliances converge, there will be increased expectations for ubiquitous wireless connectivity.

I'm pleased to announce that Syllabus2003—our tenth annual summer conference—will be held on the Stanford University campus, July 26-30. We're excited about returning to a campus environment for the summer conference and particularly pleased about our new venue at Stanford. Consider presenting at the conference. You'll find a Call for Papers on page 38.

I hope to see you at the Syllabus fall2002 Boston area conference, coming up soon: November 3-5 in Newton, Mass. For more information, see page 11 or visit www.syllabus.com.

Enjoy this issue of *Syllabus!*

Mary Grush

Letters to the editor should be addressed to the editor and sent to 101 First Street, #605, Los Altos, CA 94022, or via electronic mail. We reserve the right to edit all submissions. **News and product information** will be considered for publication. Please send all materials to Paul McCloskey. If you are interested in writing for *Syllabus*, please send a brief description of your article idea along with writing samples to the editor at the above address.

Syllabus
TECHNOLOGY FOR HIGHER EDUCATION

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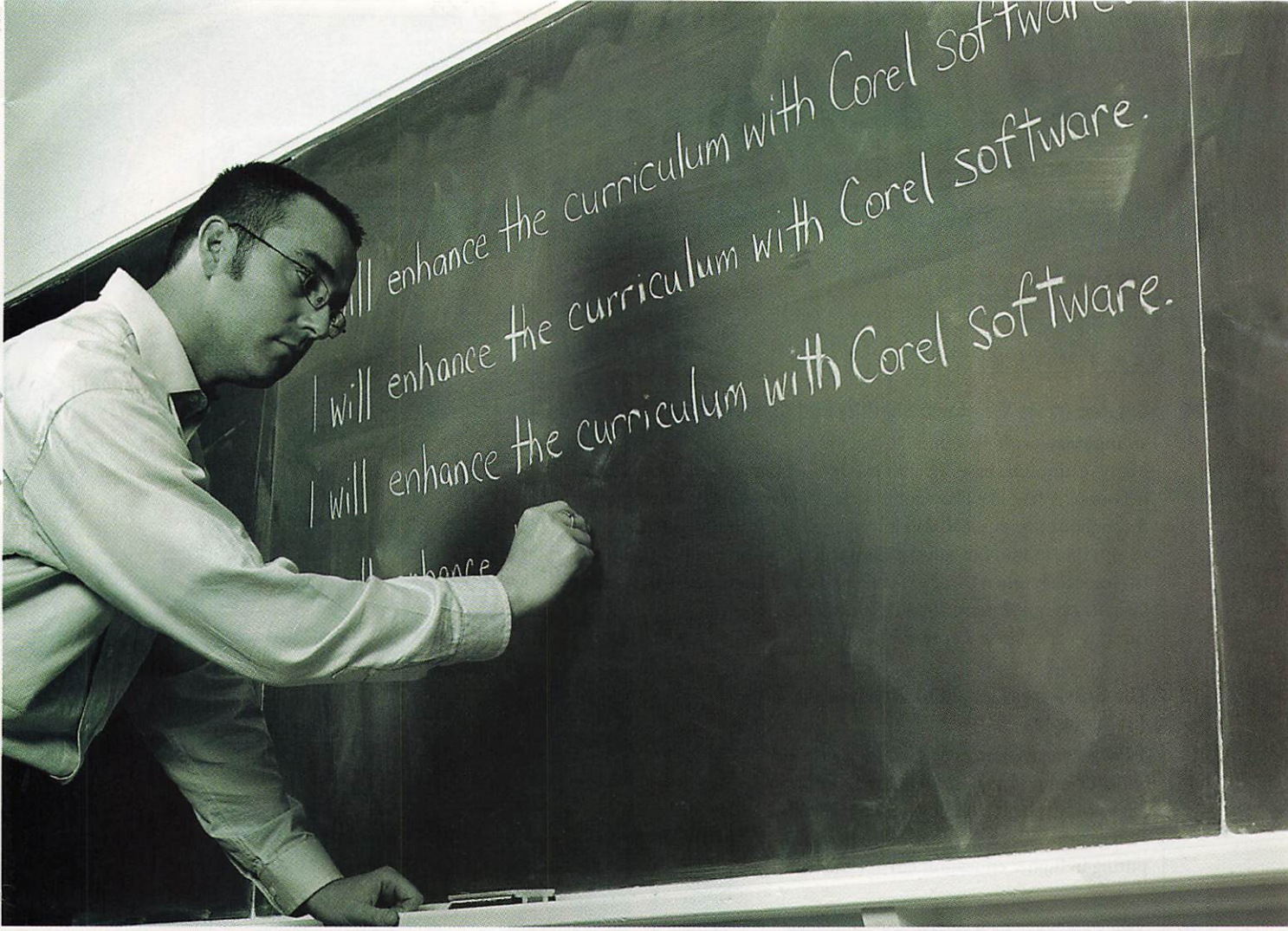
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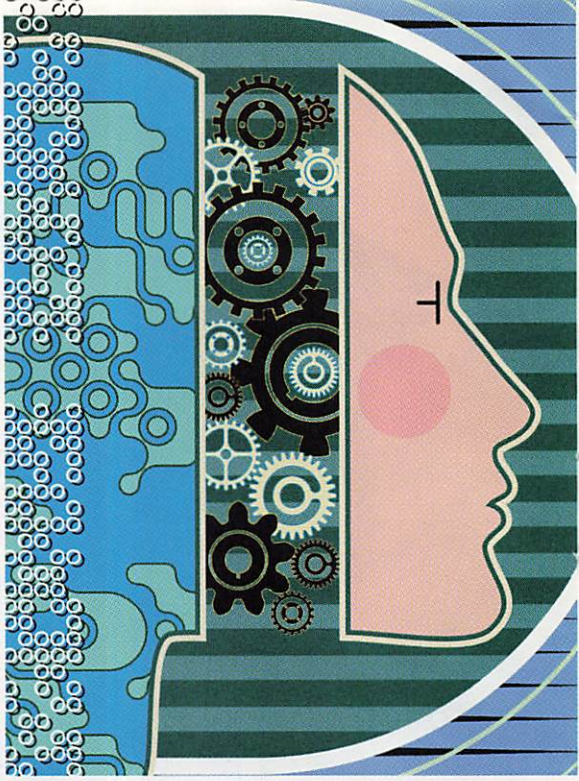

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A Primer for Educators by Gerald L. Boerner

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A report on this year's conference in Snowmass, Colorado

It may be high altitude, but discussions are down-to-earth at the annual Seminars in Academic Computing, an EDUCAUSE affiliate conference held each summer high in the Rocky Mountains of Colorado. From wireless networking to budget cycles, SAC is a great meeting for academic technology leadership.

33 Wireless Interactive Teaching Simulations

Kevin M. Oliver, Catherine C. Eckel, and Sheryl B. Ball

Can wireless applications enhance classroom learning? Yes, says Kevin Oliver, who uses handheld devices with wireless access to increase student interaction in large lecture courses.

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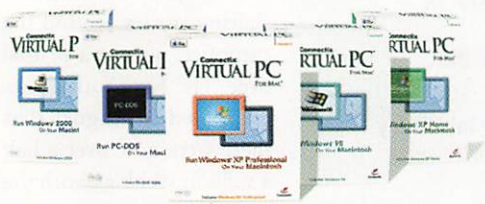

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Phillip D. Long

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TRENDS

AN INFORMATION RESOURCE OF INTEREST TO EDUCATORS

Blogs: A Disruptive Technology Coming of Age?

To blog or not to blog, that is increasingly the question for those of us supporting our academic communities. Lest you think the editor fell asleep and missed correcting that last sentence, some background is in order. In 1997 Jorn Barger coined the phrase Weblog to describe a site that combined links, commentaries, and personal thoughts and essays from the perspective of the Weblog author. The promise of the Web, however, was that everyone could publish, that a thousand voices could flourish, communicate and connect. But only those people who knew how to code a Web page could make their voices heard. For early adopters this was enough. Today it's not.

The desire to communicate is powerful and technological innovations are frequently driven by our basic needs. After all, e-mail was developed by Internet network engineers who needed to communicate about what they were doing. No one had a clue then that the text message system they hacked together was the first killer app of the new network they were building. Blogging software makes the expression of writing, including the incorporation of hyperlinks for publishing on Web pages as easy as word processing (and, given the bloated state of today's word processors, I'd say much easier). (1) Ordinary mortals with little or no knowledge of HTML can easily put their writing on the Web. People can expound ideas, describe their daily routines, or reflect on what matters to them as easily as sending an instant message.

Not surprisingly, blogging, the verb form, has been viewed as a public form of journalism, giving anyone who wishes the opportunity to comment on events of the day. Indeed, as of this fall (Sept. 2002) several journalism schools at major universities have added courses in blogging to their curricula (see U.C. Berkeley School of Journalism, <http://journalism.berkeley.edu/-program/courses/weblogs/index.html>, and the USC Annenberg School of Journalism, <http://www.ojr.org/ojr/future/1021586109.php >, for examples). This is viewed by the blogging community as either vindication of their efforts, or the usurpation of their private reserve by the establishment media.

But blogging has exploded beyond journalism (see sidebar on the growth of blogging). Web entrepreneur Jacob Schwirtz likens this growth to the digital equivalent of sharing stories around the campfire, almost a primal urge. The New York Times estimated in August that there were now over a half a million Weblogs, with the number growing.

Blogging is well ensconced in the education community. Educators in K12 and higher education are using blogging tools for:

• Student logs (writing with various intentions)

continued on page 10

Blogging's Growing Popularity

Is Blogging a Fad? Arnold Kling
www.corante.com/bottomline/articles/20020621-875.shtml

Blogging Goes Legit, Sort Of, Noah Shachtman
www.wired.com/news/school/0,1383,52992,00.html

Are you blogging yet? John Foley
www.informationweek.com/story/IWK20020719S0001/1

The Blogging Revolution, Biz Stone
www.webreview.com/2000/07_07/designers/07_07_00_1.shtml

A Nation of Bloggers and Googling by E-Mail: Blog Nation, Pamela LiCalzi O'Connell
www.nytimes.com/2002/08/22/technology/circuits/22DIAR.html

Briefs

Using a California E grant, **Foothill College** opened the Krause Center for Innovation, a regional tech training center for state K-14 teachers.

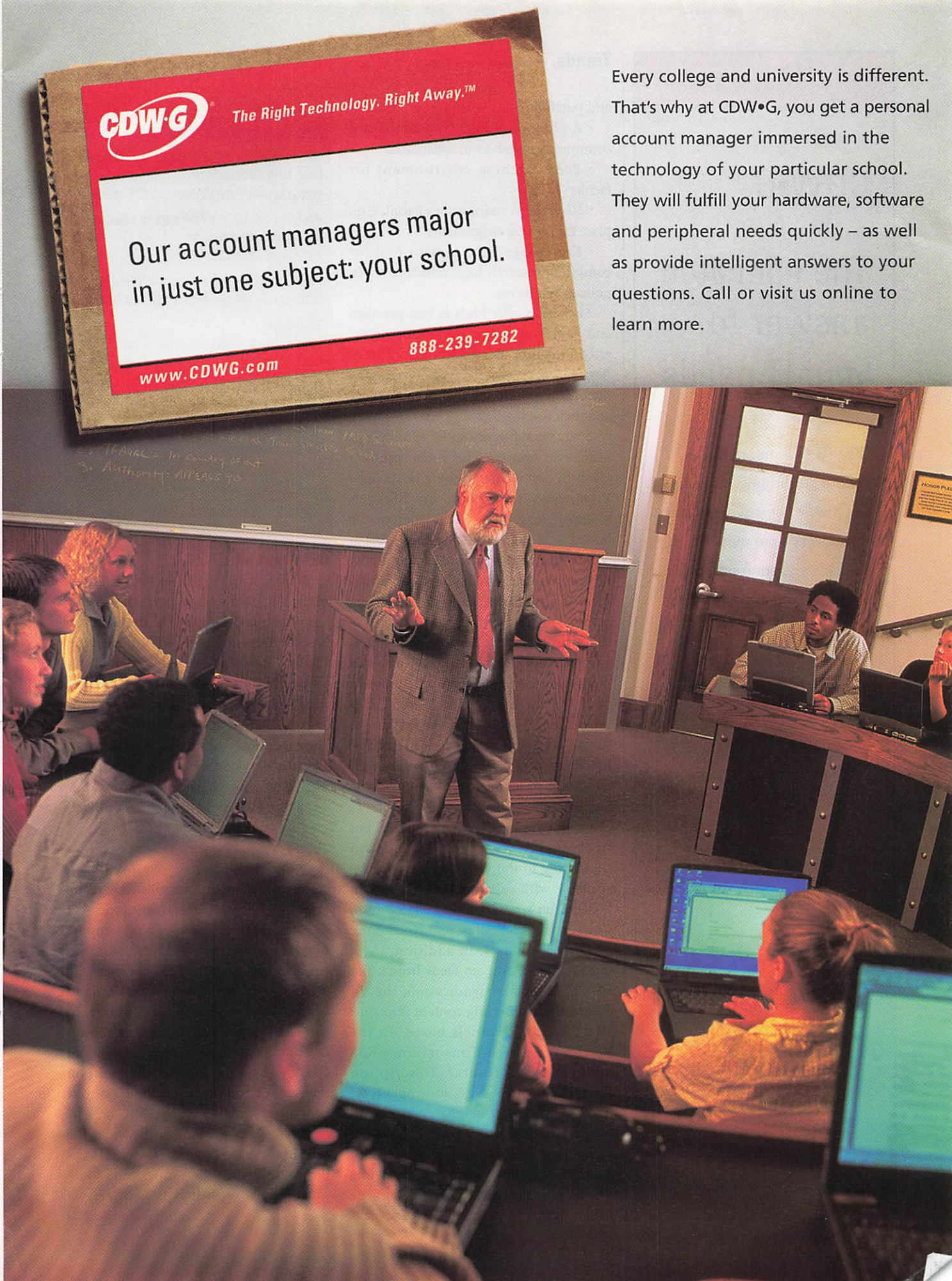
■ Training giant **Kaplan College** announced an online tool to provide background in the legal profession to aspiring paralegal students.

■ A student from **Ain Shams University** in Cairo, Egypt, won a $5,000 prize in a higher education chip design contest sponsored by Mentor Graphics Corp.

■ **McGraw-Hill** unveiled a Web-based classroom writing assessment tool that promises students immediate feedback on their writing skills.

■ **Michigan** funded five demonstration grants of up to $2 million each for schools to support one-to-one portable computing and Internet access by 2004.

For these and other news stories, or to subscribe to the weekly Syllabus e-News, Resources, and Trends, visit www.syllabus.com.



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Trends, *continued from page 8*

and portfolios

- A place for students, parents, and community members to collaborate
- Peer coaching environment for faculty
- Classroom management tool, e.g., place for posting assignments
- Knowledge management tool for compiling research logs, reference tools, policies and forms

Many sites offer hints at best practices and guidelines for new educators interested in getting started (see Educational Blogs sidebar). There is even an emerging discussion around the theory of Weblogs and their use (2)

Blogging software can be as simple as using your browser. This is the approach taken by some basic Weblog hosts (e.g., Pitas, www.pitas.com, or, Blogger, blogspot.blogger.com). A variation on the hosted blogging approach is those sites in which your blog is part of a community of users on the site. A directory of the members of the community, including optional interest profiles and related services bring together otherwise anonymous voices broadcasting personal journals to the world. Among the more well known of these are LiveJournal (www.livejournal.com) and Xanga (www.xanga.com). Xanga has all the appearance and functionality of a portal community, with news feeds and featured blogs on the home page.

Using your browser is convenient, but working on your site depends on connecting to the net. More features are available with software tools that when installed on your computer allow you to work on your site offline and synchronize when you connect. In addition, these tools permit setting up feeds from other sites that support syndication, that is, automatically inserting content into your site through channels based on the World-Wide Web Consortium's RSS application (Resource Description Format Resource Site Summary), an XML-based lightweight syndication format that can carry an array of content types: news headlines, discussion forums, software announcements, and various bits of proprietary data. For details see http://groups.yahoo.com/group/rss-dev/files/specification.html)

Educational Weblogs

Weblogg-Ed: Using Weblogs in education, Will Richardson
www.ravenrock.com/blog/blog.html, and,

Weblog-Ed: Using Weblogs in education vol. 2, Will Richardson
www.weblogg-ed.com

Middlebury College Educare Weblog
http://manila.cet.middlebury.edu/educare

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Serious Educational Technology in Search of Quality
http://instructionaltechnology.editthispage.com

DV for Teachers
http://dvforteachers.manilasites.com/

ITC Insights
www.schoolblogs.com/ITCInsights

Another approach to bringing the publishing and editing process from the Web to your desktop is the use of server based publishing software. In this case, the tool for editing your blogs is accompanied by the server software that you install on your server. Your server could be a machine you run and manage on your campus, one that is hosted by an Internet Service Provider, or one that is offered by a blogging hosting service.

Several Perl application suites for blogging are available (e.g., the popular Moveable Type blogware, www.moveabletype.org, or Blosxum, www.oreillynet.com/~rael/lang/perl/blosxom). There are powerful content management tools that provide feature rich blogging support from Userland (www.userland.com) who produce the popular Manilla dynamic content management system. Userland offers a client application, Radio, to connect to their hosted backend object-oriented content server (Frontier). You can download and install Radio to use on their site or run the whole thing on your own using Manilla.

A relative of the blogging world is the techie haven Slashdot (www.slashdot.org). Slashdot has a personal journaling feature, but it is primarily a

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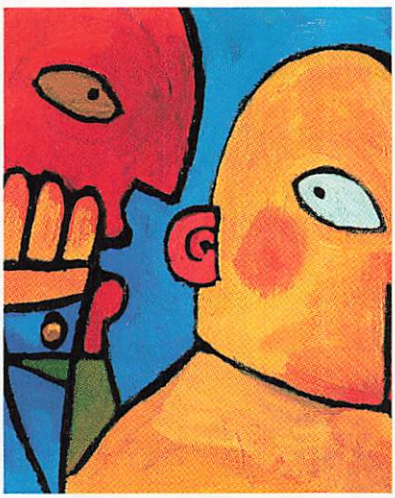
Sally M. Johnstone

As founding director of the Western Cooperative for Educational Telecommunications at the Western Interstate Commission for Higher Education, Sally M. Johnstone serves as a resource on higher education technology issues. She also serves on the board of the American Association for Higher Education, the U.S. Open University's Board of Governors, and the Advisory Panel for the Consortium for the Advancement of Private Higher Education.
sjohnstone@wiche.edu

Advise or Confound? That is the Question

For the past three years, some of my colleagues have worked with several campuses to help them develop coherent Web-based support for students. One of these campuses, a research university, is working on Web-based academic advising. Their goal is to use no more professionals than they currently have to serve more students more effectively. To illustrate the shortcomings of the current state of online advisories, here is a typical dialog between an online student and an academic advisor:



Student: *Hi. I've taken a part-time job and can't keep up with all my classes. I am considering dropping an online course. I need to know the deadlines to drop the course so that it won't affect my grade point average. I also want to take the course next term since I think I need it for my major. Can my financial aid be applied to the course next term? Can you help me?*

Advisor: *I am glad you called when you did. The last day to drop a class without grade penalties is today.*

Student: *Oh great. Can I just drop the class on the phone or online without having to come into the campus?*

Advisor: *Hold on. There are some things you need to check to be sure you can take the course next term and whether dropping the course might have an effect your financial aid this term. You need to contact your academic department to see if the course will be offered next term. Some courses are not offered every term or even every year. You also need to contact the financial aid office to see if your funding will be affected.*

Student: *Oh, man. Can you tell me who I need to talk to in the department to find that out? I don't have a campus phone directory here. Can you also help me get the number for the financial aid office?*

Advisor: *I can give you the numbers but I am not sure the financial aid office can work with you over the phone. For privacy reasons, you have to show them an ID before they can tell you anything about your status. Besides, after you have the information you need, you will still have to come to the campus to sign the drop forms. You have about 3 hours left before this office closes.*

Student: *Well, I am at work. I can't just walk out, drive through rush hour traffic to the campus just to stand in lines. When are you folks going to make all this reasonable for those of us who don't live in a dorm?*

This is pretty tough on our student. She can take the course online but trying to navigate the rest of the campus system is overwhelming. The campus with which my colleagues are now working determined there were 17 different databases used across their campus that would be needed to give students direct answers. They plan to make those available in some form to all their academic advisors.

Needless to say, the task to which these campus leaders are committed is not a simple one. Few of these 17 databases can now talk to one another. The advisors will have to learn how to navigate these databases. They will also have to learn new ways of working with students as well as the people who manage those databases so they can be sure they are giving their students the most current information available. But in the end, I believe the value to both the online and on-campus students should be worth all the effort.

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Mobility and Campus-

An Interview with Lawrence M. Levine

One of the first institutions to have a campus-wide network 15 years ago, Dartmouth College, is still a pioneer– the college now has one of the first campus-wide wireless networks. Here, *Syllabus* interviews Larry Levine, director of computing at Dartmouth, for his insights into wireless networking on campus.

S: How long have you had a campus-wide wireless network at Dartmouth?
LML: We began our project to create wireless access throughout the campus in November of 2000, and we had a very ambitious schedule to finish by April of 2001. So, by the end of April or early May 2001, the entire campus, indoors and out, had what we call *a wireless overlay*– wireless access along with the wired network.

S: So it's been a little more than a year. Have you been studying what's happened in that year?
LML: There's been one formal study plus a constant collection of anecdotal data, from the mundane, where we monitor the wireless Access Points, up to social engineering kinds of assessments. We've talked to various groups on campus and elicited reports from individual users. Especially when we first installed all of this, people would report to us about locations where they couldn't get a signal, or they thought the signal was weak, or they found that their machine was bouncing between two access points...this is mostly corrective feedback.

S: Did you end up changing where you had located your APs?
LML: Yes, we did. We have more than 500 Access Points. It's an art form to figure out where to place them, and decide how to adjust their signal strengths–it doesn't work well to simply turn all of them up to 100 percent because they will interact with each other. There is always a lot of tweaking regarding placement and adjustment of APs.

S: Did you come up fairly quickly with all those wireless areas?
LML: From November to April 2001, as we installed Access Points, we turned them on. So during the five- to six-month period, the campus was lighting up, so to speak. Every time we'd do a building or a cluster of buildings, we'd turn them on, and leave them on.

S: Would it be easier to begin by designing AP placement into a brand new building than to work in older buildings?
LML: Well, it would be cheaper. Putting in a wireless network, there is a lot less physical work than goes into a wired network, but where we found that we had a greater expense than we had estimated was in getting wires to specific locations in buildings for Access Points. In many cases, we had to call in an electrical contractor and create a pathway that didn't previously exist because good places for Access Points are often high up and behind walls, or on ceilings...not the typical locations where you'll find existing network wires. It is clear that this could be cheaper if you could have all this done when the building was being built.

S: How did you decide where to place Access Points?
LML: There is a lot of trial and error in the process. One of the ways we did this was to have teams of students go around and plug an AP into the nearest network jack, with a long wire to the AP, and actually test out 2 or 3 various locations.

Wide Wireless convergence

S: It sounds like the word "wireless" really applies to the user side not so much to the administrator side.
LML: Definitely. The connection from the user to the Access Point is wireless, but the connection from the Access Point to the network backbone is typically wired.

S: Do you consider Dartmouth to have wireless access literally everywhere?
LML: In April/May of 2001, we announced to the campus that we had reached our target of providing wireless access throughout the campus. We issued a friendly challenge, to find a place on campus where you could not get wireless access, and we would make sure that access was made available there. We have access points in places like the stadium and even at the ski area. But there were some students who pointed out that they were sitting in the cemetery that we have on campus and they could not get wireless there. So, we repositioned an AP on the outside of a nearby building to cover that.

S: So you came through on your guarantee!
LML: Oh, yes. We in fact put access points in the boat house. You can paddle around in a canoe on the Connecticut River adjacent to the campus and have good wireless access.

S: How do you find that people are using wireless? You've had wireless for more than a year–how are people picking up on this? How are they changing their habits?
LML: In terms of just daily living, it's increased people's ability to connect with each other at any time, either through e-mail, which is the classic method, or through instant messaging–various forms that people use, typically AOL's Instant Messenger. It shortens planning horizons for meeting people and getting together.

S: But there have always been ways for people to communicate about their meetings. What is different about this?
LML: It increases spontaneity. It allows people to communicate and make changes and ask questions even more on the fly than they could before.

S: Do you mean for social or academic communications?
LML: It includes social things, but also students talking with faculty, or students checking some piece of information online more readily than they did before. We have wireless in the stacks, and even though students could walk around the library before with their laptops, now they can be connected to the Dartmouth network or the Internet the entire time.

S: Has teaching changed? Are their any trends there that you can identify?
LML: I don't think that it has changed how faculty teach. For the typical faculty, teaching is still lecture- or classroom-style. They may say "Let's look this up..."but they don't, for the most part, say, "Be sure to bring your laptop to class."

S: Are there any departments where the wireless access may be used as a part of the class?
LML: Yes, in the School of Business, and maybe some classes in the School of Engineering–those are professional schools, notably.

S: Are there any cases where there is intensive use of handhelds during class?
There is one faculty member in the Psychology Department, who, because of the wireless network did radically alter the way he teaches one class. He acquired 80 Handspring Prism devices with wireless sleds and uses them in an ongoing way while he lectures, and he has students downloading information in class, pertinent to the lecture. The students interact with the server, with each other, and sometimes with his teaching assistant, all during the class. He did all this specifically as a way to make students be more actively engaged with the information while it's being presented to them.

S: How do the students react to that? Is it pretty positive?
LML: Oh yes, they love it. Students are much more comfortable with various kinds of gadgets–they thought that this was great, and novel and stimulating.

S: So do you find that it's mostly the students that are picking up on wireless communications, rather than classroom use as determined by the faculty?
LML: That's true–there is not a lot of live teaching use with wireless. Where the use takes place I think is outside the classroom as people do their work and as they communicate with each other. It frees people up.

S: What about use in the dorms?
LML: Our study revealed that wireless was used more in the residence halls than anywhere else, but that would seem to make sense with almost a 100 percent residential campus, and a general expectation that students would be the group making the most use of technology. All the residence halls have been completely wired for more than 15 years. It's not like students haven't had network access in their rooms or lounges before, but with wireless, they have more flexibility. They have access in their rooms, in the hallways, on the lawn, literally wherever they want to be.

S: Are the students bringing portable devices to campus, then?
LML: Everyone is required to have a computer. Though it doesn't have to be a laptop, most of them are bringing laptops and to a certain degree, the availability of the wireless access is driving that decision.

S: When they set up their wireless access, is it fairly straightforward for them?
LML: Yes, in fact, that is one of the real advantages and reasons for providing wireless access. It's an easy-to-use, robust technology, not much harder that setting up a cordless phone. It works well and it is not at all hard. It's also relatively inexpensive.

S: How does the use of the wireless network compare now, with the use of the wired network?
LML: Clearly, the wired network, in terms of reliability and performance, will always exceed the wireless network. It is hard to beat an actual physical connection, for speed and reliability. The wired network will always be a step ahead of the wireless network. That's why we'll always have the wireless network as an overlay of the wired network–we'll always have both.

S: So you see the wired network as continuing into the future?
LML: Yes–if we put up a temporary building, or someone has been given an odd location for office space, we might run with wireless for a while until we have a permanent location to wire, but the wired network will still be ubiquitous.

S: But then you have to maintain both?
LML: Well you could say that, though they are really both the same network. The wireless network is connected to the wired network. Of course, it is an additional maintenance burden and cost.

S: Do you think that many campuses will offer campus-wide wireless access?
LML: A few have. Most campuses have some wireless access. In my view, as long as you have a network, that should mean wireless as well as wired.

S: What are the security implications for a wireless network?
LML: In the case of Dartmouth, our access points are all from Cisco. But the wireless cards that people use in their laptops could be from any vendor–anything that will work with the 802.11b protocol. And we had to do that, because a lot of people use Macintosh laptops that come with internal wireless cards from Lucent. Other users can buy PC wireless cards from a variety of vendors. We didn't feel we could tell people what type of cards they must use. All of this means that we cannot have a single-vendor security solution. And there are no standards that have evolved to the point where you can have a practical security solution that works across vendors' products and doesn't unduly burden users.

S: Meanwhile, how does that change how you do security?
LML: We don't! That is, on wireless, we don't make users validate to log on. Passwords are still encrypted, but we don't encrypt the entire flow of information between a wireless client and Access Point.

S: So it seems like for a while, the security is just going to be a whole lot better on the wired network.
LML: That's true. We want to end that as soon as we possibly can, though we'll have to wait for the standards to evolve. For now, we don't encrypt the bulk of the information being transferred, and we don't authenticate users. We don't ask for a name, or a password, or a certificate, and we don't register the unique address of the user's wireless card or of your laptop.

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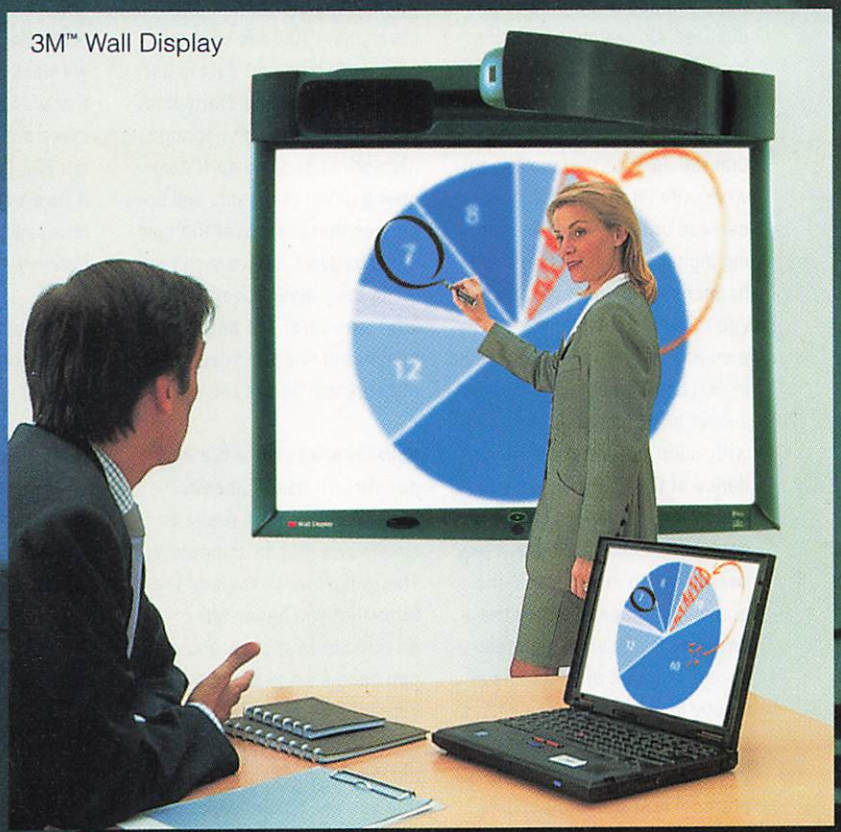

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S: One of the things you always hear about in discussions of wireless networking and mobile computing is digital convergence. What do you think about the notion of convergence?
LML: For me, convergence begins with the idea that anything you see or hear can be digitized. Once you've acquired it as digital information, you can store it and communicate it and manipulate it. So that means that the devices that we use to work with information that we can see or hear are all becoming digital devices. When that happens, they converge. So if you think of a telephone as just a means to transmit digital audio in real time, that makes it just a subset of a computer. The same with video. You can see the evidence of that everywhere you look. Wired telephone networks have been digital for quite a few years now. In many cases, the actual instrument used by the end user is still an analog telephone, but a lot of people have wholly digital telephones sitting on their desks. Cell phones have become almost all digital–the 3G protocol is starting to become the dominant cellular protocol. Then you have palm devices and Windows CE computers that also are telephones and also carry a lot of the functionality of your laptop; your laptop can also be a telephone, and can certainly do all the things that a PDA can do. These devices can have video cameras, microphones, speakers, and audio out–all of them have can have these features built into them. So there's definitely a technical convergence of wireless networking and appliance.

S: Then how does this convergence affect the way people work with these technologies?
LML: Along with the convergence of networking and appliance, you have a sort of convergence of the ways people use information. People interact with information and with other people, both in real time or asynchronously. And the convergence of voice and data is particularly interesting. Dartmouth is going to move its telephone network to become an IP telephone network. People will have phones that work over the computer network, so we won't be using the present phone network anymore. The network for computers and the telephone network will be the same.

S: What are some of the ways people will use IP phones?
LML: IP phones will really be small voice-based computers. This will allow all kinds of features that you haven't had on traditional phones. You can have a small screen–your telephone can connect to the Web and interact with the Web at the same time that you are talking with someone. It also means that you can have a single phone number that can be on multiple devices and follow you around anywhere you go. I could give you my one phone number, and when you call me, it would ring on one or more devices. It doesn't matter whether I'm here in Hanover, or on the moon, as long as I have a connection to the Internet and that connection can be wireless.

S: So we will of course have wireless IP phones.
LML: Of course. A wireless IP phone uses the same wireless network that a wireless laptop uses. In addition, bridging has been done–at least by Sprint, and probably by some other vendors–between 3G cellular technology and 802 wireless technology. So, I can take a wireless handheld IP phone, that also is a cell phone, and make a call on campus using our 802.11 wireless overlay–and if I walk off campus, be seamlessly picked up by Sprint's PCS network.

S: So convergence is involving a lot of technologies.
LML: These technologies are all merging. Video video cameras, video phones, computers, PDAs–the appliances you use are converging, changing the way you think of being connected to people and information.

Along with the convergence of networking and appliance, you have a sort of convergence of the ways people use information.

S: It seems like there are a lot of different devices being used in different ways on wireless networks. On a campus, does there need to be a kind of top-down structuring of the devices that people can use with the network, or will this kind of sort itself out?
LML: It think that overall there will be a growth in the convergence of different kinds of appliances, and as people try out these things, there will be a shake out–things that are successful will emerge. The primary digital appliance people use on campus now is their laptops. And while we have encouraged people to use laptops, we have not dictated that this is what they should do. And we don't insist that they make their laptops wireless–but people like being wireless, so even if we weren't pushing wireless, they would be seeking it.

S: It seems like users seek out the technology that they need–and wireless seems to be a technology that people need.
LML: Our students have been accustomed to carrying their laptops around, even before the wireless network. They really are already mobile–the whole campus is their home–so adding the wireless network access was a natural step for them. It just adds to their mobility.

The Brave New World of Wireless Technologies

A Primer for Educators

Have you just received funding to install a network in one of your campus's older buildings? Great! Now what? Why not opt for wireless? Here, Jerry Boerner offers some basic knowledge of wireless networking.

By Gerald L. Boerner
AZUSA PACIFIC UNIVERSITY

How do you retrofit an older building with today's networking infrastructure? If the building is built with thick interior walls, or with bricks, or is otherwise architecturally unique, your options to run network cabling on the surface of walls may be limited. You may also discover that you do not have easily accessed spaces above the ceilings, (e.g., no "false" ceilings) into which to install the cabling. And the installation of either copper wire or fiber cabling may require thousands of feet of cable and many hours of painstaking labor to connect. Are there any alternatives to the installation of physical wiring?

Five years ago the answer would have been a resounding *no!* Today we can safely answer the same question with an emphatic *yes.* Wireless local area networks (WLANs) are now feasible and available at reasonable prices from a variety of vendors. However, the array of acronyms that face educators is imposing and overwhelming; the technical staff in your networking group may not be fully aware of the options. In most colleges and universities, networking personnel are much more comfortable with wired local area networks (LANs). What is 'Wi-Fi' anyway? Do we need to understand the difference between FHSS (Frequency Hopping Spread Spectrum) and DSSS (Direct Sequence Spread Spectrum)? While the technical details of these implementations of wireless communications are beyond the scope of an introductory article, we will examine the technologies available for implementing wireless networks today and suggest guidelines for selecting the most appropriate for our colleges and universities.

The Traditional Wired Network

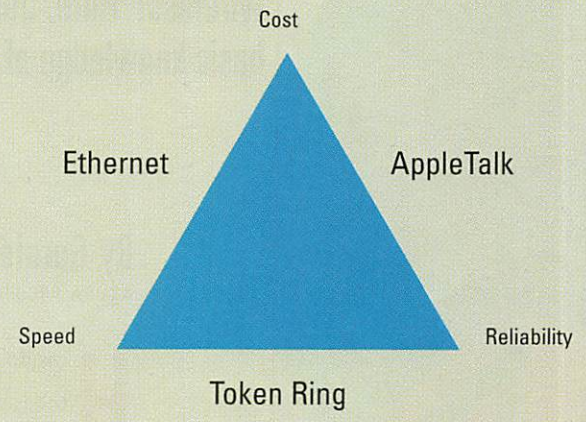
Starting in the mid-1980s, the choice focused our attention to three aspects of network infrastructure: cost, speed, and reliability–we could pick any two! Therefore, we arrived at the following compromises:

- *High speed and low cost:* Ethernet at the sacrifice of reliability
- *Low cost and high reliability:* AppleTalk at the sacrifice of speed
- *High speed and high reliability:* Token Ring at the sacrifice of cost

Today, this picture has changed substantially. But while our choices are much different, we are still limited to two of the three elements when designing a wired network. We introduce these concepts here so that as we examine wireless technologies, we can focus on the same three factors–speed, cost and reliability.

Traditional Network Wisdom

Comparison of the three major network factors and the types of network technologies associated with each pair of factors



The Wireless Network

A wireless LAN requires essentially the same components as a wired LAN: a network interface card (NIC), a communication media (copper cable, fiber optics, etc.), a set of rules that follow a standard (protocol) for interpreting the communication signal, and an operating system that understands and maintains the connection between the local and remote computer. What differentiates a wireless network is the use of non-physical media for carrying our information between nodes of the network. A wireless LAN uses several different bands of the frequency spectrum; these frequencies are outside of the normal visual spectrum.

A wireless LAN adds to this mix a special device, the Access Point (AP) to the network. This device communicates with both the wireless device through the Radio Frequency (RF) signal and the wired network through standard protocols like Ethernet. In addition, both the Access Point and the NIC must include antennas to allow access to the RF spectrum. The key elements in designing a wireless LAN are the number, placement, and configuration of Access Points for optimal performance.

Wireless Networking Standards

Wireless LANs have been implemented in recent years via several standards. However, only the IEEE standards defined by Project 802.11 have resulted in sufficient production of devices that enable us to implement WLANs in our colleges and universities. Two variations of this standard are now producing devices for implementing our WLANs: IEEE 802.11b (11 Mbps in the 2.4 GHz band) and IEEE 802.11a (54 Mbps in the 5 GHz band). Both of these technologies function in the unlicensed spectra: the former uses the ISM band while the latter uses the U-NII band. Which one do we choose? Let's take a closer look at the strengths and weaknesses of these technologies.

IEEE 802.11b is the more mature of the two technologies, and devices (NICs and Access Points) compliant to this specification began appearing in 2001. These devices are available at a modest price and have an effective throughput that is adequate for most normal WLAN applications in the office, lab, or classroom. This throughput fluctuates as a function of the number of devices sharing the channel, distance, and obstacles through which the signal must pass, but in general ranges between 2 and 11 Mbps. The key to deploying this technology is the placement of the Access Points and the assignment of computers to frequency channels to spread the load.

The downside of the 802.11b standard is the relatively slow speed of transmission. Since the maximum speed set by the standard is 11 Mbps, throughput for these devices is the slowest of the 802.11 family of protocols. In addition, the 2.4 GHz range is relatively limited and has only three communication channels available–these channels must be assigned carefully in areas of dense wireless use, such as computer labs or in smart classrooms. Finally, the major weakness of 802.11b lies in security; the use of the Spread Spectrum (DSSS) technology and Wireless Equivalent Privacy (WEP) offers only very basic protection of the data being exchanged.

IEEE 802.11a is the newer technology on the scene, with devices compliant to this standard only appearing in the marketplace in

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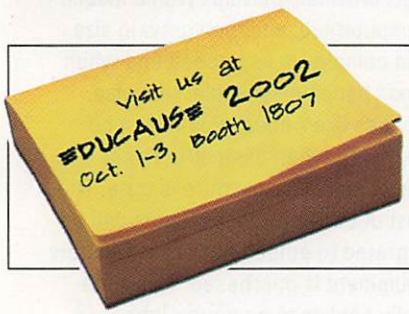

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2002. This technology has a higher throughput at short ranges (up to 10 feet), making it the candidate for use in bandwidth-intensive applications such as multimedia. Unlike the three channels available to 802.11b, 802.11a has eight separate communication channels. This enables more computers to be connected without taxing the system. The use of a multiplexing technology, OFDM, also provides for enhanced security, although it still employs WEP as its major security component.

Again, on the downside, 802.11a currently has several severe drawbacks. A major disadvantage lies in the chip production technology required; chips cannot be produced as CMOS chips, but must use more expensive technologies. Until the volume of sales of these chipsets increases, 802.11a devices tend to be much more expensive than 802.11b chipsets. In addition, it is a less mature technology and must work through the refinement process. Finally, 802.11a is reliable within a range of 10 feet, but the speed drops dramatically beyond 20 feet. This requires that Access Points be located more closely to the users to maintain both reliability and speed.

For a better understanding of wireless standards, we need to return to the basic three elements that characterize a network: speed, cost, and reliability. We must remember that we can have only two of these. So where do our wireless technologies stand in this analysis? We have already stated that a designer can choose which two of the three elements we value the most. When this analysis is applied to wireless technologies, what do we get? Let's take a closer look.

•*High speed and low cost:* The IEEE 802.11a devices

•*Low cost and high reliability:* The IEEE 802.11b devices

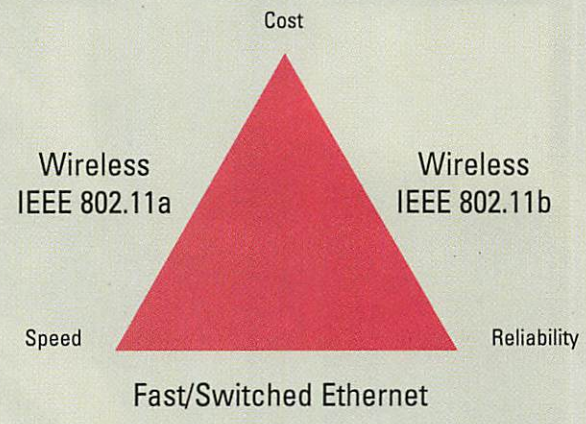
•*High speed and high reliability:* At present, no wireless technology meets these criteria; we must stay with our wired LAN technologies like fast, switched Ethernet to meet this requirement!

Enhancements to the 802.11 standards offer solutions in the future, but our present offerings are limited to those specified above. When products start appearing for some of the emerging standards, this scenario needs to be revisited.

While a variety of technologies exist for implementing wireless local area networks, the IEEE Project 802.11 family of standards is the most promising at this time. Which of the 802.11 standards is superior? That question is harder to answer, due to the differences in RF band (ISM vs. U-NII) and access technology deployed (DSSS vs. OFDM). In the long run, 802.11g and/or 802.11i will probably offer the most promising solution. These technologies are

Wireless Network Wisdom

Comparison of the three major network factors and the types of wireless technologies associated with each pair of factors



Characteristics of Wireless Networking on Campus

Mobility: The mobile user or student can move from classroom to classroom with their WLAN-enabled computer and still access the Internet, file servers, library resources, and so forth. This mobility can extend to conference rooms or study rooms used by faculty or students in the course of their planning and study.

Installation speed and simplicity: The use of wireless in older buildings can save considerable money and challenges posed by retrofitting to support networking. The wired LAN infrastructure can be minimized and used to support the necessary VLAN connections and Access Points in the classrooms.

Installation flexibility: Flexibility is offered in both the networking of dedicated computer labs and the use of mobile computer labs. This can allow any classroom to become a computer lab, as needed, with the use of computer carts. The primary requirement for a mobile lab situation is a computer "drop" to which the access point on the mobile cart can be attached.

Reduced cost of ownership: While mid- to high-end Access Points are not inexpensive, the overall investment in the wireless infrastructure is, in the long run, less expensive than retrofitting cables into old buildings. And by not having fixed positions, rooms can be adapted for different uses in the future without writing off the cost of the wiring; this is especially true of computer labs where the number of drops would be substantial.

Scalability: The wireless LAN could start off small, perhaps with a mobile computer lab, and then grow in size and complexity as needed and when funds become available. Likewise, devices like Access Points can be upgraded when the instructional needs and infrastructure dictate. The cost of current Access Points can be migrated to other locations when new equipment is purchased. This especially applies to computer labs.

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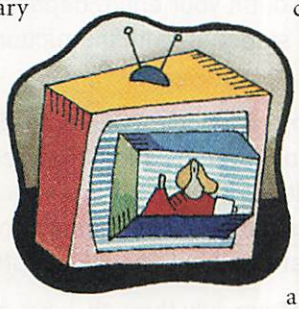
David G. Brown

David G. Brown is vice president and dean of the International Center for Computer Enhanced Learning. He has served as president of Transylvania University, chancellor of the University of North Carolina at Asheville, and chair of several national groups, including the American Association for Higher Education and the Higher Education Colloquium. As provost of Wake Forest University, he founded the Annual Conference of Ubiquitous Computing Colleges and Universities, and founded the Journal of Computer-Enhanced Learning.
brown@wfu.edu

Connecting with Students

For the past two summers I have had the privilege of speaking at the Annual Conference on Improving University Teaching and Learning (www.iutconference.org). Centered around rigorous research on pedagogy and learning theory, these conferences attract directors of teaching and learning centers from around the world, as well as many faculty. Last year Nelson Mandela welcomed to Johannesburg delegates from 31 countries. This summer we were greeted in Vilnius by Lithuania's president, Valdas Adamkus.

At one of the conference plenary sessions Marcel Lucien Goldschmid, professor at the Ecole Polytechnique Fédérale de Lausanne in Switzerland, Daphne Pan, director of the Centre for Development of Teaching and Learning at the National University of Singapore, and I facilitated a "town meeting" where delegates from 20 countries shared ideas about five teaching strategies. They boiled down to the "Five C's."



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Contacts: Increase contacts with individual students and customize assignments by taking into account individual interests and learning styles. Convey a sense of caring to each student and make learning more convenient by considering your students' circumstances and study conditions.

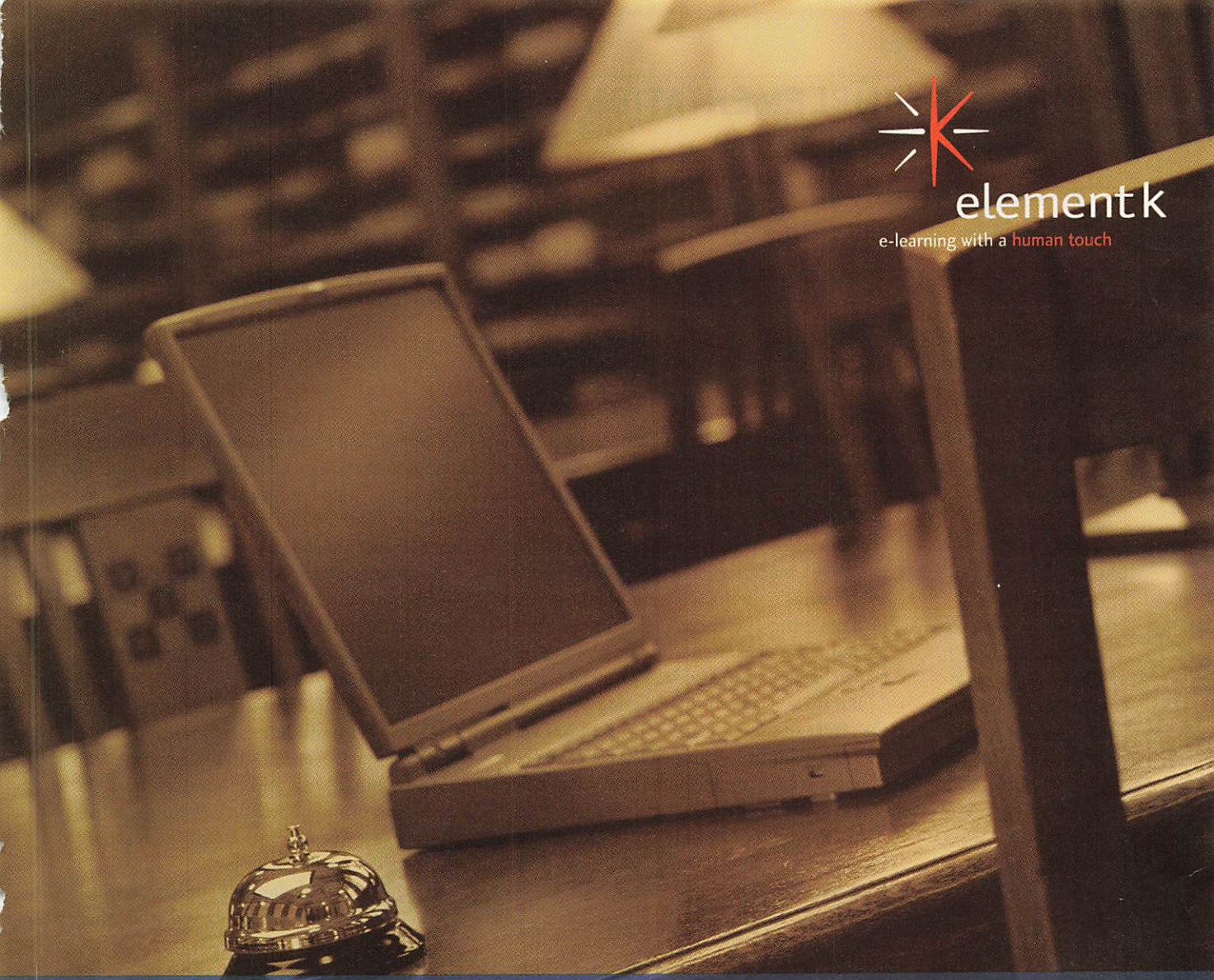
Concepts: Allow for more practice using concepts. Assign more problem sets, use surveys, test questions, and dynamic exercises.

Cinema: Include more pictures, movies, and simulations and expect students publicly to share what they have learned. Record in-class experiments for later replay and encourage students with role-playing assignments.

The delegates, working in groups of five or six, offered over 100 specific ideas about how, with and without technology, to implement these five strategies. Here are 10 of these ideas:

1. Create an atmosphere of trust.
2. Build and sustain the learning community via e-mail between teachers and students, students and students, and students, teachers, and experts.
3. Provide fast feedback to students, even if some messages must promise a response later.
4. Let students know when and how you prefer to be contacted, including how often you intend to access e-mails.
5. Create online forums, threaded discussions, and chats.
6. Use the Internet to access experts and ideas from "beyond the classroom."
7. Form student study groups with specific intent. For example, group by similar interests, group by different skill sets, or group by diversity of cultural backgrounds.
8. Keep groups small, suggested optimal size no larger than eight.
9. Assign teams to work together on projects.
10. Link each student with a mentor or a specialist in the field.

A constructive exercise for any group concerned with quality teaching, like the IUT delegates, is to share specific ideas about the five teaching strategies. Conversation can be catalyzed by using the "Five C's" as a worksheet.



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Steven W. Gilbert

Steven W. Gilbert joined the American Association for Higher Education as director of technology projects in July 1993. He founded the TLT Group as the Teaching, Learning, and Technology Affiliate of AAHE in January 1998. He was previously vice president of EDUCOM, where he created and led the Educational Uses of Information Technology program and the EDUCOM Software Initiative. He also moderates the Internet Listserv TLT-SWG.
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Personalizing Pedagogy

New applications of information technology have provided a variety of choices in higher education, not only about what is taught and learned, but also about how it is taught and learned. During recent years, there has been a lot of excitement about new ways to use information technology to meet the needs of learners more effectively, including new pedagogical techniques in individualization, learner-centeredness, and anytime-anywhere education.

But there has been a fascinating oversight at the center of this movement. While it has taken individual differences among learners as its core premise, it has largely ignored individual differences among faculty.

Yet weren't most faculty members students earlier in their lives? Does the aging process diminish differences among us? Are faculty members self-selecting to such an extent that variety among them is negligible in most important dimensions? I doubt it. Consider some of the many ways which faculty members can be effective teachers. It would be absurd to expect anyone to be a highly skilled teacher in more than a few of them:

Connect with students. Enable students to feel more fully a part of the institution or community. Reveal enough of themselves to engage students' interest and energy on a personal level. Demonstrate care about the students as learners and human beings.

Organize information. Organize subject matter within an academic discipline so that learners new to the field or topic can rapidly encounter and understand important issues, and identify with the most important knowledge, skills, and information.

Use media. Use different media to create and offer effective speech, written materials, graphics, animations, laboratory experiences.

Create a "safe" environment. Help students overcome their fears of learning, of school, of teachers, of competing for attention in a classroom, of failure. Convey and engender confidence in students' abilities.

Be an attractive role model. Serve as a role model—personally or professionally—by demonstrating depth of mastery, wisdom, knowledge, skill, character, and enthusiasm for the subject and profession.

Work with different-sized groups. Work effectively with students in small, informal groups or one-to-one. Skillfully generate and guide discourse with and among learners via face-to-face or online sessions. Ask provocative questions that engage learners intellectually.

Develop self-study materials. Create self-study materials that enable learners to progress at their own pace. Use a combination of media that matches their own learning styles, assesses their own progress, and demonstrates their achievement of a specified level of mastery.

Select cost-effective teaching combinations. Understand enough about teaching, learning, and technology to decide when and how to use the following techniques most cost-effectively: face-to-face time; synchronous interaction at a distance; synchronous interaction at a distance; and independent learning options.

Most faculty members have already begun using technology in their day-to-day correspondence, research, and course preparation. In addition to matching learners with teachers, and learning needs with teaching abilities, we can use new technology to engage each other more meaningfully and with greater mutual satisfaction. By examining and respecting differences in both groups, and finding technology applications that fit, we can achieve more cost-effective education.

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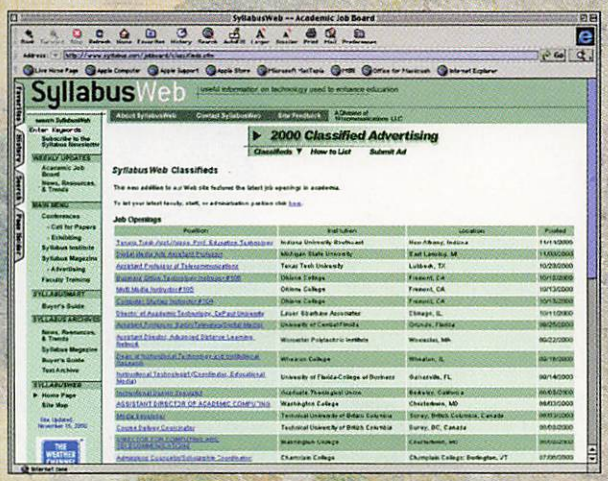

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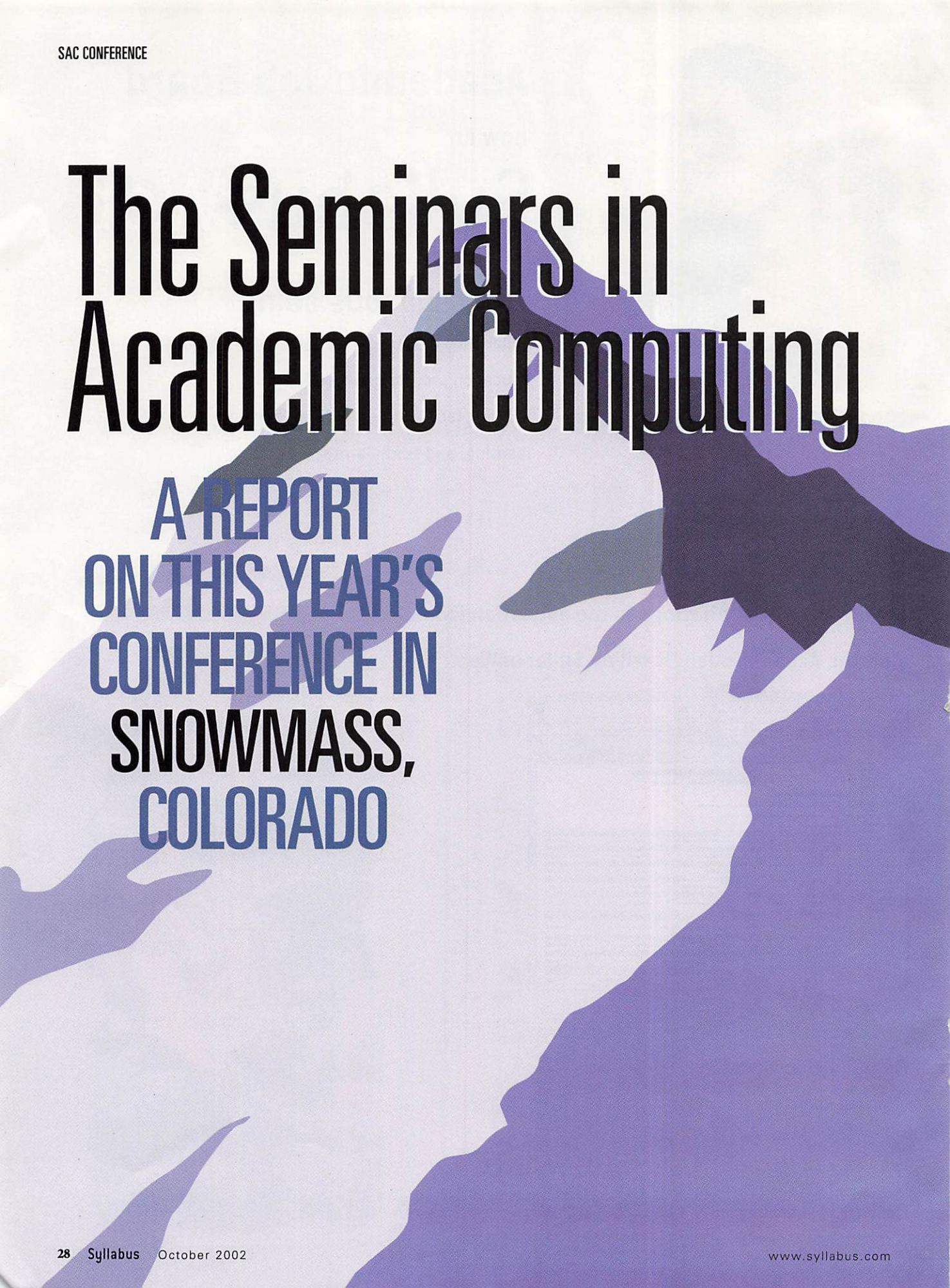
The Seminars in Academic Computing

A REPORT ON THIS YEAR'S CONFERENCE IN SNOWMASS, COLORADO



Each year, high up in the Rocky Mountains of Colorado, a small conference of educators meets to discuss issues common to those involved with academic computing. The first conference, held in 1970, was initiated in by a handful of individuals who had determined that directors of academic computing needed a training seminar, because most had been recruited from faculty with little management experience. Since then, the conference has run each summer and now provides not only executive training, but also a forum for professional communications and a key meeting around which some of the most important and far-reaching initiatives in higher education technology develop. The combination of leadership representation and small size makes SAC a powerful and strategic conference.

In 1997, the Seminars on Academic Computing became a CAUSE affiliate, and it became an EDUCAUSE affiliate the next year with the consolidation of CAUSE and EDUCOM. EDUCAUSE vice president Richard Katz spoke about the transition and about the nature of SAC: "For me SAC is one of the most important conferences within EDUCAUSE and in the higher education constellation of conferences; first, because it's quite small and the setting contains and constrains the size—I think the capacity is about 250-300 people—and second, SAC was created by the community, for the community, and has been operated by the leadership of higher education technology for its purposes. And it has really remained true to that." Katz noted that initially, there was some concern that the historical reason for being and the spirit of the conference might be compromised in the affiliation with EDUCAUSE, mostly because of the large size of EDUCAUSE and of some of its other conferences. But such fears proved unfounded. Katz explains, "We at EDUCAUSE have always felt that the best way to make these affiliation relationships succeed is to honor what made them successful in the first place, and second, to remove from the shoulders of those who have made [the conference] a success the myriad logistical minutia that successful conferences are all about. EDUCAUSE exists in part to deal with those kinds of things.

Today, SAC is structured in three parts: a University Executive Seminar, a New Directors Workshop, and the Directors Seminar—the main event. The 17-member SAC program committee selects topics and invites presentations for the Directors Seminar with input from others, including SAC board members. "This is a conference of volunteers", says Paul Gandel, current SAC board chair and dean of university libraries at the University of Rhode Island. "The reason the conference exists is because people want to come here and exchange ideas."

The program committee, which is representative of the range of SAC attendees, reflects upon the topics of immediate interest on their campuses, thereby developing highly relevant program topics. This year, topics ranged from wireless technologies, to security, electronic portfolios, eLearning systems, portals, bandwidth issues, video-over-IP, open source, and legacy systems, to budget cycles, decision making strategies, career moves, and developing leadership. Many of the papers from this year's conference are published on the EDUCAUSE Web site at www.educause.edu/conference/sac2002/.

Every year, the Clair Maple Address is the featured plenary session. Opening keynoter Graham Spanier, president of Penn State University and this year's Clair Maple speaker, reminded attendees that universities need to understand their customers better, and that "The expectation levels of both faculty and students have dramatically risen as technology has changed educational opportunities for everyone." This theme was reflected in numerous other presentations as technology leaders recognized the demands created by a changing technological environment.

Some sessions attempted to capture or characterize some of the areas where technology needs to be especially watched or researched. A panel on the EDUCAUSE Center for Applied Research (ECAR) asked attendees to suggest some of these potential research areas, and a session titled "What Technologies Should We Watch?" also solicited input from attendees.

The value of SAC goes well beyond the formal sessions. Attendees are continuously involved the exchange of information, and breaks and evening time when attendees can get together are as key to this process as the published sessions. Many groups, including other EDUCAUSE affiliates and groups with interests in specific technology projects or areas—examples are such areas as OKI, PKI, or broadband costs—plan their meetings surrounding SAC, given the number of their members attending the conference.

SAC serves a dual function, both as a forum for experienced CIOs, as well as a place for newcomers to get their—footing. This year, one of the "newcomers" was Julian Lombardi a new assistant director of learning solutions at the University of Wisconsin-Madison, a veteran biology faculty member of 13 years, a developer and early adopter of technology for education, as well as an entrepreneur in technology for knowledge architecture and complex self-organizing systems. Lombardi attended the University Executive Seminar as well as the Directors Seminar. Lombardi's goal was "...to listen and try to gain an understanding of what the issues are." The strategy worked for him: "It was very satisfying to see that the thought processes that go into a lot of the decisions that are made are so well-crafted and well-defined."

"SAC works", says Gandel. "Someone once described it to me as magic. Who would have thought that three computing directors saying, 'Let's get together this week' back in 1970 would have created something that would continue this long. You don't find many things that just keep going, based essentially on interest."

SAC generally meets in late summer, around the first week in August. Next summer's dates are August 1-6. For further information, visit www.educause.edu.

still awaiting implementation, however. When faced with the choice of selecting 802.11a or 802.11b, the safest choice will probably be 802.11b except in applications that require higher throughput over a restricted range.

Security Issues

Security is the major drawback of wireless LANs. Basic security can be provided by WEP. This is sufficient to start with, as long as the security features are enabled and the NICs support 128-bit encryption. However, WEP is only basic security and is not sufficient for critical data like student records or other secure transactions.

Additional, sophisticated devices from Cisco Systems and 3Com are required to allow more reliable authentication. These solutions are implemented by using a combination of more advanced Access Points and a RADIUS server that maintains a list of the authorized MAC addresses that are permitted to log into the WLAN.

Current Access Points allow the WLAN to be enabled without requiring that encryption be turned on. In addition, many Access Points allow their Service Set Identifier (SSID) code to be broadcast frequently, so outsiders may be able to gain access to the WLAN. Proper configuration can provide a reasonable level of security, but care must be taken to implement and use security options consistently.

The basic WEP protocol incorporated into most IEEE implementations is inadequate for high-security applications. This problem can be resolved by selecting augmented security schemas and authentication techniques. Future standards are being developed to incorporate these changes into the wireless protocols. However, if high-security applications must be accessed, the wired LAN is still the recommended.

Opting for Wireless

Wireless LANs should be seriously considered when upgrading campus networks. The technology has matured and provides a positive set of advantages, including: cross-vendor interoperability, practical interference-free communication over reasonable distances, and minimal security that can be augmented by several emerging technologies. Access Point devices have advanced to allow scalable connection with the wired campus infrastructure, and students and faculty can roam the campus and maintain their network connection. Above all, retrofitting older buildings with networking using wireless technologies lowers the overall cost of ownership and facilitates faster installation, simplicity, and flexibility; and, except for connecting Access Points, physical wires no longer need to be run through walls or between floors.

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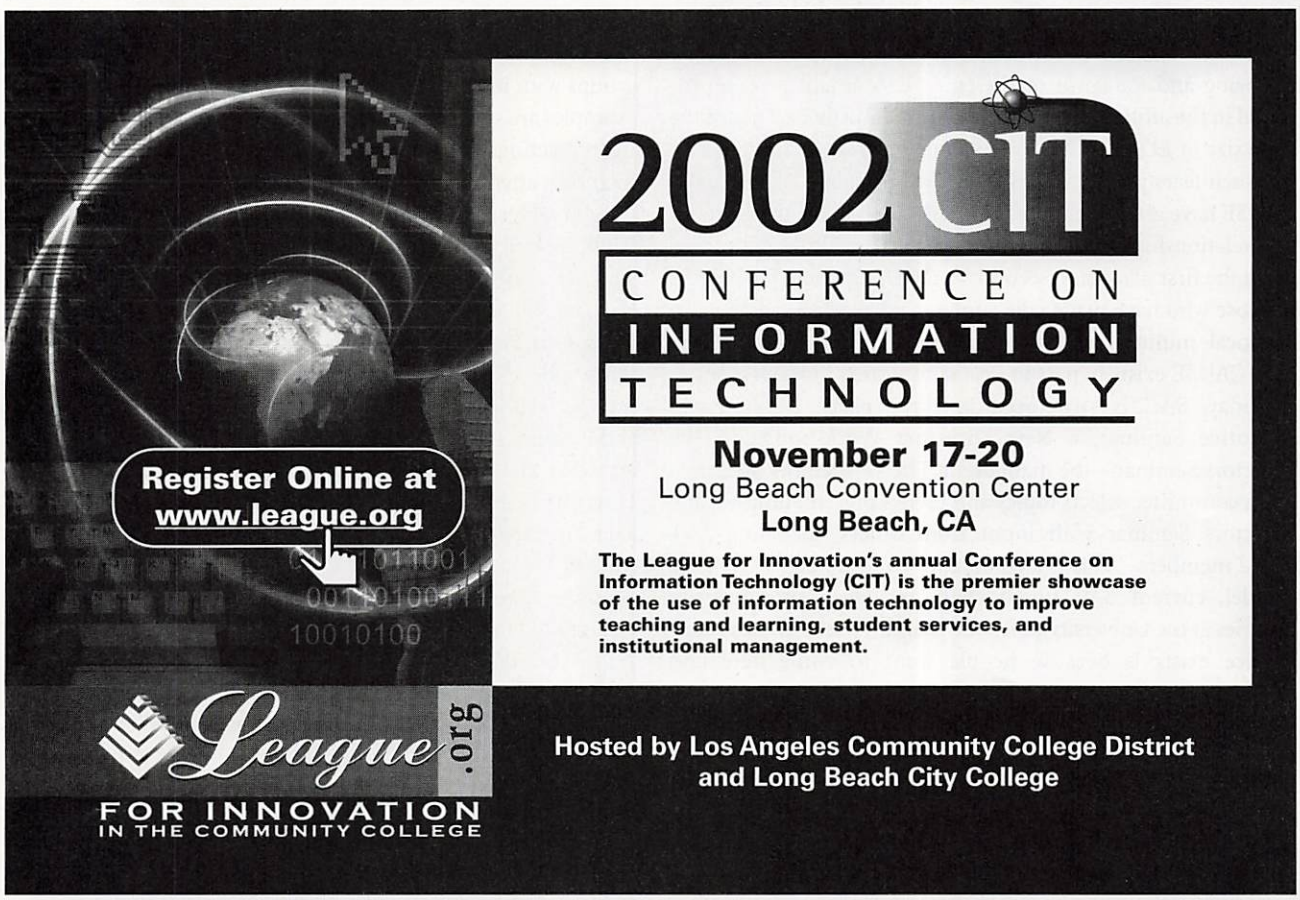
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Glossary of Wireless LAN Terms

Access Point (AP): A device connected to the wired local area network that receives and transmits signals to wireless clients; this device must also be connected to the wired LAN if connections to external networks are required.

Authentication: A process that verifies that the user has permission to access the network; often associated with the process of joining a Bluetooth piconet or WLAN.

Channels: Another name for frequencies, especially within a defined band.

Direct Sequence Spread Spectrum (DSSS): A spread spectrum technique that uses a "chip" (redundant bit pattern for each bit to be transmitted) to encode the signal to ensure more reliable delivery; the technology employed in IEEE 802.11 implementations.

Frequently Hopping Spread Spectrum (FHSS): A spread spectrum technique that uses a range of frequencies and changes frequencies during the transmission; the technology employed in HomeRF (SWAP) implementations.

Industry, Scientific, and Medical (ISM) Band: An unregulated radio frequency that uses the 900 MHz and 2.4 GHz bands for communication; these bands were approved by the FCC in 1985.

Orthogonal Frequency Division Multiplexing (OFDM): A multiplexing technique used in 802.11a WLANs; this technique minimizes the effect of multipath distortion encountered in 802.11b networks.

Spread Spectrum Transmission (SS): A technique that takes a narrow signal and spreads it over a broader portion of the radio frequency band.

Unlicensed National Information Infrastructure (U-NII) **Band:** An unregulated radio frequency that uses the 5 GHz band for communication; this band is divided into three subbands and are intended for use by short-range, high-speed wireless digital communication devices.

Wi-Fi (Wireless Fidelity): Another name for IEEE 802.11b standard; this trademark is owned by WECA and devices that comply with it assure interoperability among vendors.

Wired Equivalent Protocol (WEP): The IEEE specification for data encryption between wireless devices defined by the IEEE 802.1x standard.

Wireless Local Area Network (WLAN): A local area network that is not connected by wires but instead uses one of the wireless technologies.

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Trends, *continued from page 10*

moderated community discussion space. However, the software that powers Slashdot is itself an open source community effort provided under the GNU Public License to anyone interested at http://slashcode.com. It powers a number of sites around the Web including Harvard Law School's blogging site for the dissemination and discussion of legal news concerning information technology, http://grep.law.harvard.edu.

The growth of blogging may actually portend something else. The explosion of blogging is in part due to the march of technology, which has made what was once difficult—publishing Web content—extraordinarily easy. E-mail was around in universities and government labs for years before a simple interface and increasing reliability made it accessible and attractive to the general public. Note that Manilla software from Userland is described as a content management system. As it and products like it continue to evolve, what happens when content management becomes as simple to use as Web logs? When technology becomes simple enough, and leverages a basic human need, like communication, it becomes ubiquitous.

Companies that follow good business practices can dominate their markets and succeed. But in periods of rapid technological change, all bets are off. This was the argument made by Harvard professor Clayton M. Christensen, in his book The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail (1997) (3). Who will recognize when changes of this sort are occurring in the world of blogging? Or is it content management?

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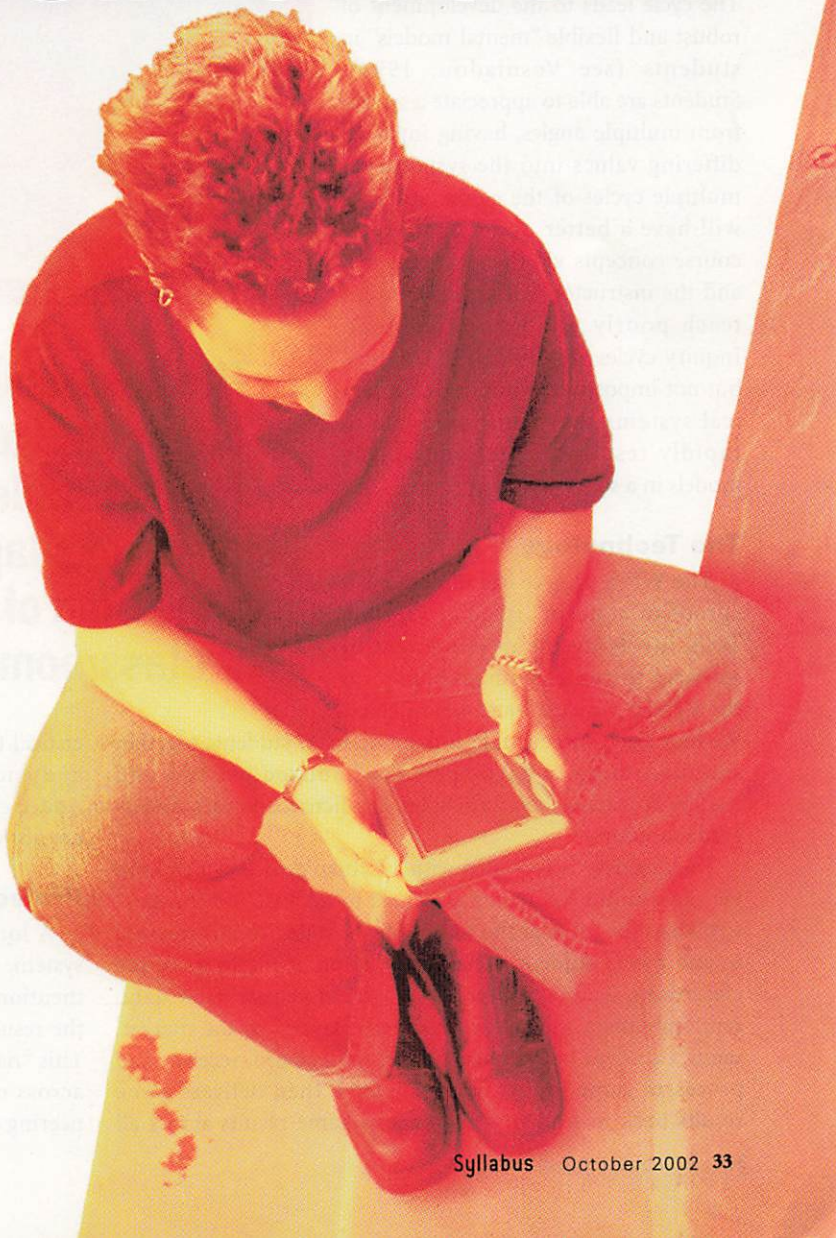
2. http://www.weblogkitchen.com/wiki.cgi?WeblogTheory
3. Harvard University Press

Wireless Interactive Teaching Simulations

By Kevin M. Oliver,
Catherine C. Eckel,
Sheryl B. Ball
VIRGINIA TECH

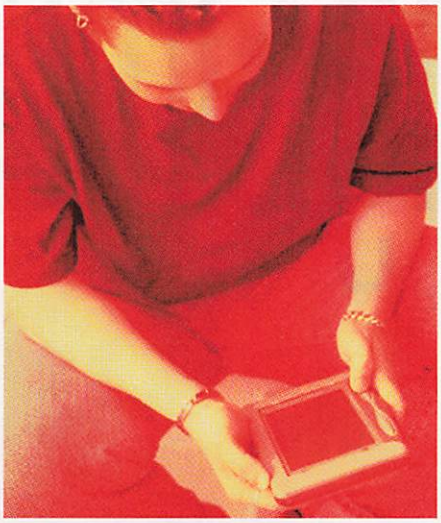


Undergraduate lecture courses at many institutions of higher education are quite large, making it difficult to actively involve students and maintain their attention. Ongoing and current budget crises make it difficult to hire additional instructors and reduce class sizes to levels that would allow for more faculty-student or student-student interaction. Wireless interactive teaching simulations (WITS) are seen as one solution to this dilemma. By leveraging emerging wireless technologies and low-cost, hand-held computing devices, we are attempting to integrate more interactive learning experiences into the very large classroom.

Student Benefits

The classroom interactions programmed for the WITS system fall into a category of tools known as manipulation tools, simulations, or microworlds (Hannafin, Land, & Oliver, 1999; Rieber, 1992). These tools tend to have the same overall structure; they allow students to externalize their thinking by "playing" some value or inputting some variable into a system. This input has some effect on the overall system, which is shown to the student. The student analyzes the results that their input had on the system, and if it is not desirable or not what they expected, they revise their initial input or attempt some modification of it. The games typically proceed through several cycles, each of which provides the student with more information to revise their initial understanding or personal model.

This process has been termed "reflection-in-action" (Schon, 1987) and "theories-in-action" (Land, 1995). The cycle leads to the development of robust and flexible "mental models" in students (see Vosniadou, 1994). Students are able to appreciate a system from multiple angles, having inputted differing values into the system over multiple cycles of the game. Students will have a better understanding of course concepts via their experiences, and the instructor will not have to re-teach poorly understood content. Inquiry cycles are difficult to conduct, but not impossible, without technological systems that allow students to rapidly test and experience many models in a short period of time.



The host device is connected to and passes student signals to a laptop at the front of the classroom.

The Technology

The WITS project has undergone a "proof of concept" stage at Virginia Tech, involving the development of software to run economics games on the Cybiko wireless hand-held device. We have been successful in linking up to 30 students together simultaneously to participate in simulated markets and trading scenarios for a Principles of Microeconomics undergraduate course.

Each student is provided with a Cybiko device, which links via open radio frequency channels to a "host" or "broker" Cybiko at the front of the room. The host device is connected to and passes student signals to a laptop at the front of the classroom. The laptop accepts student registration data, randomly pairs students with other "players" in the market, sends a student pair a particular game scenario, receives and processes game inputs from students, then delivers game results back to students. Cumulative game results across all student pairs are graphed on the laptop and projected on a screen in front of the class.

The decision to utilize Cybiko was based on cost-effectiveness, since wireless capabilities are already incorporated into the unit and wireless cards do not need to be purchased on top of the base unit price. The project is funded by the Mellon Foundation's Cost Effective Uses of Technology in Teaching program (CEUTT) as well as the National Science Foundation (NSF). A key goal for both grants is to design a system that is not only pedagogically sound, but also feasible within typical university budget constraints.

While our beta system may be cost-effective, it has functional problems. One primary bottleneck in the described system has been the single host Cybiko device which has difficulty receiving and passing all of the student data to a laptop. We need to scale up the system to larger classes and have been unable to do so with this bottleneck.

Alternative options are under consideration, including the purchase of more expensive handheld devices with wireless cards to communicate directly with a laptop. The removal of a host handheld device should increase connection speeds, however this could be a costly system if dependent upon emerging campus wireless "zones" that might require additional connection fees for each device.

A second solution is possible, but further down the road. Students at our university must purchase a computer, but they are not required to purchase a laptop. With a portable computing requirement, students could bring their own wireless-enabled laptops to class for initial setup and interactions. Students would not have to pick up a loaned handheld device or purchase their own for class activities. It will be critical to illustrate the learning effectiveness of such systems and encourage several classes and majors to participate. Added costs to students will be difficult to sell if "lecture" halls are not widely transformed to "activity" halls.

Project Extensions

A long-term goal for WITS is to create a customizable system. Economic games are but one example of the aforementioned cycle, where students make some input, analyze the results, then revise their initial ideas about the situation. This "reflection-in-action" is a valuable instructional strategy across numerous fields: sociology, political science, engineering design, chemistry, physics, and many more.

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Our software requires further refinement, specifically a user-friendly interface that allows instructors to program their own unique game models with specific conditions and to rapidly change game conditions in response to student questions (e.g., "What if we add variable X into the system?"). For example, one can envision a class studying genetics, with students inputting various mutations into a system with some overall effect as the output. As the cycle is repeated multiple times in succession, students quickly see the different effects their inputs/actions have on the system.

This allows the students to build flexible and robust mental models about the systems they are studying. Students don't just understand the effect X has on Y, they also understand the effect V, W, and X have on Y from a second modified example of the game, the effect V and W have on Y without X from a third modified example of the game, and so on. Understanding is broadened. While a generic interaction is probably better than a lecture class with no activity, a multi-cycle interaction designed to build robust student mental models will be better than a simplistic multiple choice response (e.g., "If you are satisfied with today's lecture, select A, unsatisfied, select B.").

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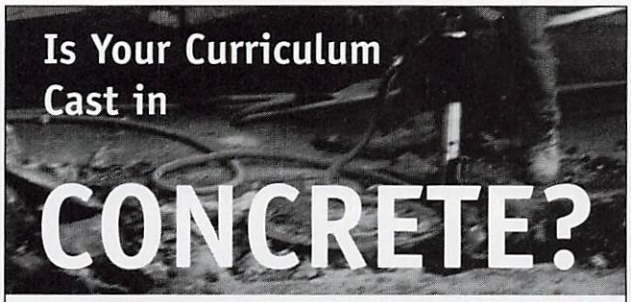

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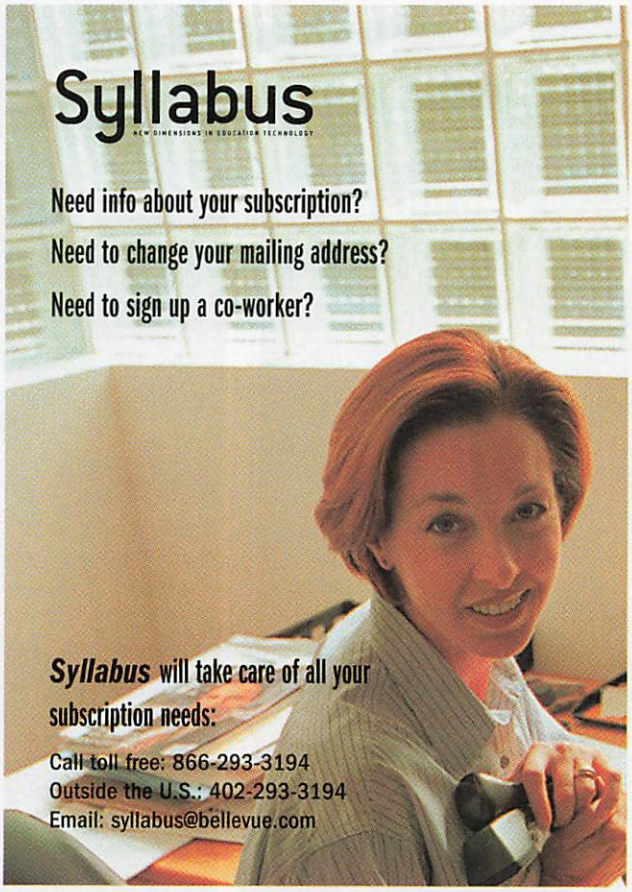
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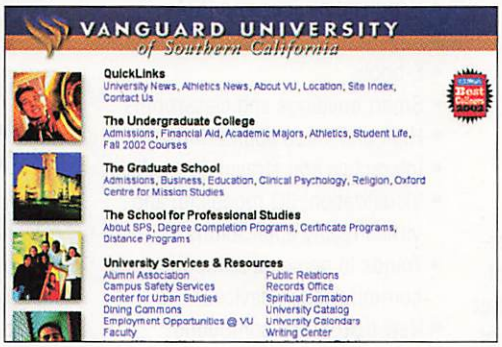
Vanguard University upgrades campus Web site from 'brochureware'; George Mason University network built to keep pace with service demand; Wireless multitasking at the University of South Florida; Michigan university consortium collaborates on eLearning software; Optical imaging applications at Penn State.

Vanguard University

Streamlining Campus Web Publishing

By Andrew Kenney

In 1995, Vanguard University built its first Web site (www.vanguard.edu). Like many organizations on the early World Wide Web, the site was mainly "brochureware." By late 1999, it had grown to nearly 300 static HTML pages that were infrequently updated because the process of adding or editing pages required development of a new HTML file and the reworking of navigation image maps. Site editors were limited to a handful of staff and faculty with significant technical skills. Consequently, content was often outdated and site visitors regularly e-mailed complaints, particularly about university news and sports stats.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As the school's newly hired full-time Web master, I spent nearly all my time trying to keep the backlog of update requests from growing larger. I had little time to move the site's infrastructure forward or add critical new features. Something had to change, and as it turns out, everything did.

After setting priorities for the needs of the site based on visitor usage, I began by building the site's athletics section using Microsoft Active Server pages. I created a custom-built content management system (CMS) with page templates that were served from a database and updatable via browser-based, custom-built data-entry forms. Vanguard's sports information director began posting her press releases, game wrap-ups and stats using this custom-developed system. E-mails about outdated sports stats ended. Now, I had more time to build out other areas.

While Vanguard's custom-built CMS was a big step forward, it was not a long-term solution. Entering content into the forms required non-technical people to learn basic HTML skills. Content editors using the form couldn't see the page as it would look on the site. They had to proofread the content after publishing it to the site, then login to the CMS again to make revisions if mistakes were found or the page did not display properly. The system offered no way to add tables, pictures or media without content editors learning more advanced HTML. Code validation before publishing was impossible. The need for content editors to have technical expertise meant the solution was limited to only a slightly larger group than before. The university required a more user-friendly solution.

While continuing to build on my custom ASP-based CMS, I explored off-the-shelf options. Some solutions lacked the functionality we needed. Others had far too many features and a price way out of Vanguard's range. I couldn't find a system that was "just right." Specifications for the new CMS included the ability to:

- Write flawless HTML and/or XHTML
- Add tables, pictures and other complex page elements without learning HTML
- Easily add rich media
- Auto-strip proprietary HTML and MS-XML from pasted MS Office documents
- Be easy to use (i.e., no technical ability required and little or no learning curve)

I found nothing that could meet that challenge until I came across Ektron's eWebEditPro, a stand-alone, browser-based, WYSIWYG content authoring tool. Unlike other Web editors such as Dreamweaver, FrontPage, or GoLive, this editing tool is designed specifically for use by non-technical people. It essentially replaces HTML <textarea> fields with a word processor-like interface complete with toolbar buttons for spell-checking, linking, tables, image upload and more. For under $300, I got a 10-user license and added the tool to my custom CMS.

Just One Problem...

My vision for the site involved adding many more content editors. But as the lone Web developer on campus, I already lacked the time to

Call For Papers

Syllabus2003

Plan now to present at Syllabus 2003!

Held on the campus of Stanford University

Syllabus is pleased to announce its 10th annual summer conference

July 26-30, 2003
Palo Alto, California

Pre-conference: Saturday and Sunday, July 26-27

Main conference: Monday-Wednesday, July 28-30

Proposal deadline: November 30, 2002

Conference Information

The Syllabus annual summer conference grew from a small gathering of education technology professionals at UC-Santa Cruz in 1994, to a series of annual events held at Sonoma State University in 1995-1998, to a major annual conference that moved to the Santa Clara Convention Center for 1999-2002. This coming summer, we return to our roots by again meeting on a university campus—Syllabus2003 will be held on the campus of Stanford University. We are looking forward to an atmosphere that will encourage a lively exchange of ideas and offer a sense of community. Get your proposal in soon for a conference that promises a wide range of topical coverage while maintaining an environment that fosters interaction with colleagues.

Content Areas and Tracks

In four broad tracks, we examine the central themes and key technologies which have become increasingly critical to informed decision makers in higher education.

Track 1 - Interactive Media and New Technologies for Education

A look at current and emerging technologies in higher education environments, including applications of new interactive media.

- Wireless applications in education
- Handheld devices and PDAs
- Advanced networking applications
- E-books
- Smart buildings and classrooms
- High-end video applications
- Interactive and streaming media
- Visualization, 3D modeling, and virtual reality applications
- Trends in personal computing and communication devices
- New distributed computing applications in education
- Virtual laboratories
- Course management systems
- Portals for admissions and alumni communications

Track 2 - Technology Implementation: IT issues

IT issues spanning infrastructure and security to planning for large-scale technology programs.

- Technology infrastructure and IT planning
- Student administration systems
- Professional development and faculty support
- Online distance learning programs and collaboration technologies
- Scalable models for distance and distributed learning
- The globalization of .edu: policies and practices
- Standards and open source
- Security for campus environments
- Accessibility issues and universal design
- Web search engines and finding tools
- Peer-to-peer networking strategies
- Web publishing for the academy
- Digital libraries: resource aggregation/distributed collections
- Intellectual property
- Content management systems for .edu

Track 3 - Teaching with Technology

An examination of technology trends and pedagogical implications.

- Instructional design
- Technology and pedagogy
- Student assessment practices
- Security issues and online testing
- Web-based content resources in education
- Testing your course: standards for Web accessibility
- Going the distance: reaching new student populations
- Managing course size on the Web: success criteria
- Web course development tools
- Web-enhanced teaching environments
- Course development and faculty rewards

Track 4 - Cluster Sessions

Technology application success stories and exemplary case studies are featured in this track. An opportunity for faculty to share their successes in using technology for teaching and course administration, and administrators and IT professionals to share information about implementions of technology on campus. Clusters offer 2-3 related presentations per session.

- Showcase of teaching with technology: lessons learned
- Adoption success stories: "real world" implementations of new technology for teaching or administration
- Cutting-edge technology and pedagogy
- Collaboration among students and faculty using Web/Internet technologies
- Curriculum redesign examples
- Student perspectives of Web courses and online programs
- Discipline-specific case studies of teaching with technology

Pre-Conference Seminars

In addition to presenters for the main conference program, Syllabus is seeking individuals to lead full- or half-day seminars during the pre-conference, on Saturday and Sunday, July 26 and 27. The seminars are classroom-style presentations that explore education technologies.

Syllabus2003 Conference Program Advisory Board

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How To Submit A Proposal

Interested parties are invited to submit proposals via e-mail per the following instructions. All relevant proposals will be considered, so if you have a compelling education technology topic related to but not specified in the above list, please feel free to submit a proposal.

Syllabus is now accepting proposals for the following session types:

Main conference sessions

- One-hour breakout session—main conference only
- One-hour panel session—main conference only
- Poster session—main conference only
- Cluster session—2-3 related technology applications presented in one session

Pre-conference seminars

- Half-day classroom seminar—pre-conference only
- Full-day classroom seminar—pre-conference only

Submission Guidelines

Submissions should include the following information:

I. The title of the presentation

II. The proposed format, e.g., breakout session (see session types, above)

III. An abstract of the presentation content (600 words or less)

IV. An indication of the conference track(s) into which your topic would most likely fall

V. A brief session description suitable for publication (one 75-word paragraph)

VI. Name and academic title (e.g., Ph.D. or Ed.D.) for each presenter

VII. E-mail address and phone number for each presenter

VIII. Presenter bio(s) suitable for publication (one 75-word paragraph each—be sure to include current position and affiliation)

IX. Any further information that might be helpful in determining the relevance of your topic to the conference

The final date for submissions is November 30, 2002. Notification of acceptance will be made by January 10, 2003. Proposals will only be accepted electronically.

Submit your proposal by e-mail:

mgrush@syllabus.com

Please include the following in the subject line (where "lastname" is the presenter's last name):

Syllabus fall2003 lastname

Speaker Discount: Presenters whose proposals have been accepted are entitled to receive a "speaker" discount of approximately 35%.

Note: As a condition of acceptance, each presenter will be required to submit, by March 15, 2003, a 1,000- to 1,500-word article for consideration for publication in the conference proceedings, in *Syllabus* magazine, or on the Syllabus Web site.

focus on enhancing user experience and building out the site's infrastructure to handle increasing visitor traffic. That's not to mention developing and maintaining an enterprise-class CMS that offered workflow and versioning for a large and diverse group of editors. I began a search for another product to meet these evolving needs. Fortunately, my search for a solution was short. Ektron had recently launched its own CMS, Ektron eMPower. The application incorporates the eWebEditPro tool, which was already familiar to the content editors, along with workflow, versioning and other features I required. The solution was also priced lower than other off-the shelf systems I had considered.

In preparation for rollout to production, I built a Windows 2000 staging server and loaded it with MS SQL Server 2000, ColdFusion 5.0, Microsoft IIS and eMPower. My decision to use ColdFusion (CF) did not come easily, because I had bought in to the stereotype that CF did not scale well. After testing CF for a few weeks though, my concerns were gone. It scaled just fine, and more importantly, because of CF's approach to writing code, I found an answer to my ongoing problem of not having enough time to write complex applications.

With a baseline staging environment in order, I built templates with Vanguard U. graphics and other page code to hold the eMPower content blocks which would be served from the database. I then began transitioning content from the production site into the SQL Server database using eMPower's GUI.

Populating a database with HTML content, linking templates to user groups with multiple levels of user permissions, adding style sheets and tracking all content locations can be a nightmare, but with eMPower I literally created a new page in the CMS, then copied content directly from the current production Web site and pasted it into the editor. Every page element, including tables, pictures and links were rendered perfectly in the editor, and it even re-wrote the code into XHTML for me. All I had to do was save it. The content was automatically placed in the database and tied to the template and user permissions I had assigned. Writing the templates, building out production servers and transitioning 900 pages into the CMS took about 3 months. When I was finished, I had a completely dynamic site that could be updated by anyone, and the total software cost was under $20,000.

Is it Better to Buy or Build?

Building may be the right answer for some, especially if there's concern about limitations associated with locking into a "do-it-all" out-of-the-box product. Custom-development, however, can take a substantial investment of time and money. If you're considering the "build" option — whether in-house or via contract — be sure to evaluate the investment of time and money associated with developing a custom system and the flexibility it will offer in the future. Some CMS vendors now offer a "component-based" approach, where the CMS does not dictate the site's infrastructure. Instead, the CMS is a building block for the site. This building block offers core CM functionality, then functions with the site's business logic and other third-party components (for e-commerce, Web trends analysis, site/page speed, etc.).

If you're looking for an off-the-shelf system, remember CM systems vary widely. Carefully define the scope of what you need, then shop for a system rather than letting the shopping experience dictate a full line-up of "requirements." Academic institutions often require a core set of content management functionality. Many CMS's include features that you may consider "nice" but aren't "necessary." These tend to inflate the cost. So shop cautiously.

Some Interesting Effects...

While I was forecasting Web site growth due to the CMS, I didn't anticipate an explosion in the number of pages, content editors and visitors. In July 2001, Vanguard's site had 900 pages. As of July 2002, the site had over 2,500 pages, an average of 140 new pages a month. In July 2001 there were three content editors. A year later there were 40. And by fall 2003, I anticipate 75+. In 2000, the site averaged 15,000 visitors a month. In 2002, that number doubled, with a recent record-high of 40,583 in April. Admissions applications have risen 35 percent from August 2000 to August 2002.

With Vanguard's enterprise-class CMS package in place, I can now teach university staff and faculty "how to fish" rather than just "giving them a fish." I have no concerns about bad HTML, rogue scripts, or someone inadvertently changing the look and feel of the site. I can turn people loose to build out the site's content while I focus on building back-end and middle-tier features to improve the site for visitors, faculty and staff. Recently, I rolled out a new search engine and added hardware to handle increasing visitor traffic. I've also developed a custom press release application that functions seamlessly alongside the CMS.

While it's impossible to overstate the difference to my job and the benefits to our Web site since the transition to our current CMS, the work is not yet finished. I have drastically reduced time spent training Web editors and the time it takes to update the site, but some departments are already "maxed out" with other work and don't have time to perform routine site updates. The idea of a Web-centric marketing plan is also still percolating through the university. These two issues, and others, require further work so that the CMS fits better into our particular campus culture.

Content management systems provide powerful functionality for Web professionals to Web-enable people across an organization, allowing them to take a more active role in optimizing the value of the Web site. I will keep evangelizing about Web site value, while working toward a realistic content management process for faculty and staff. None of this would be possible without the CMS at our disposal. Everything has indeed changed.

Andrew Kenney is the Web master of Vanguard University, Costa Mesa, Calif.

George Mason University

GMU Network Caps Costs, Not Service

George Mason University is deploying a new highly scalable optical network that will enable the university to connect local area networks at each of its three campuses to create one virtual multi-campus LAN. Going with an optical fiber solution rather than simply buying more bandwidth will also allow the network to grow with the university. And GMU is growing quickly; enrollment is expected to top 26,000 this fall.

According to Randy Anderson, director of Network Engineering and Technology at GMU, this will allow the university to get out of the habit of constantly buying more bandwidth and instead will allow them to develop an infrastructure that will grow with the university. The dark fiber laid between the university's three campuses will facilitate the delivery of large data files, video, voice, and images with no loss of performance.

GMU is using Nortel Networks products—OPTera Metro 5200 Multiservice Platform, Passport 8600 Routing Switch, and Business Policy Switch—to provide point-to-point gigabit Ethernet services over a dense wavelength division multiplexing (DWDM) system. Voice traffic will be implemented in the near future, replacing tie lines to the PBX system.

According to Anderson, GMU's three-campus structure presented a special challenge. "Each campus is growing rapidly and each has specific needs," he says. "It was important to link the three campuses with a very high-quality high-bandwidth network in order to fulfill the goal of having a distributed university in which each student and faculty member has access to the resources of all three campuses, with little duplication of services and materials."

The new optical network will help them achieve a number of objectives from a single location. For instance, it will facilitate the remote backup of file servers across the three campuses. It will permit fast and efficient remote access to campus services, much faster than through the T3 lines.

"It was important to link the three campuses with a very high-quality high-bandwidth network in order to fulfill the goal of having a distributed university where each student and faculty member has access to the resources of all three campuses."

Videoconferencing will become more reliable and dependable. The Fairfax campus will have four dedicated video classrooms that can pull in or send out streaming video. Anderson notes that "the optical fiber network allows us to cap bandwidth costs without capping bandwidth."

The network will also further GMU's mission of technology innovation through research and will assist faculty with technology-dependent projects. For example, the Prince William campus, which has a strong biotechnology component, needs access to supercomputers to process its bioinformatics research data. Says Anderson, "These are huge data files. Without the private optical network, it would have been very expensive to conduct this research, moving these files around." The new network gives Prince William researchers access to the supercomputers at the Fairfax campus for data management.

With the upgrade to optical networking, GMU is also working to increase its presence in Network Virginia, offering itself as a GigaPOP site for other member institutions.

Currently the optical network is in place between the Fairfax, Va. and the Prince William, Va., campus, and between Fairfax and the Arlington, Va., campus (site of the law school and school of public policy). A third segment, linking the Prince William and Arlington campuses to form a protected ring, has not yet been funded.

The optical Ethernet network will allow GMU to increase bandwidth without adding to costs. The alternative would have been to continually add bandwidth through additional OC3 lines—an expensive proposition. The network also gives the campus flexibility in terms of its technology plans. "This plan allows us to build for the future without speculating on what it might hold," says Anderson.

For more information, contact Randy Anderson at ***randers4@gmu.edu.***

University of South Florida

Going MoBull: USF's Wireless Solution

If Florida university students are representative of the nation, then cellular telephone companies must be pleased. More than half, and possibly as many as 90 percent, of the students at the University of South Florida use some type of wireless device. While cell phones predominate at the commuter school, students are also using pagers and handheld devices such as Palm Pilots in record numbers.

Many of these wireless users want to make use of the technology in new ways. Call it technology multitasking. A year ago, some of the students approached their information technology department, asking for text messaging connections to campus activities and services. The department responded with a plan to link students to on- and off-campus services in a way that is potentially profitable for the university as well.

According to George Ellis, associate vice president for information technologies at USF, school officials had been interested for some time in developing a project in wireless messaging, but the money just wasn't in the budget to create a new program. The request from students inspired a plan that should, in time, break even, eventually turning a profit for the school. Ellis and assistant director for information technologies Christopher Akin created a messenger application that delivers text messages to students carrying wireless devices.

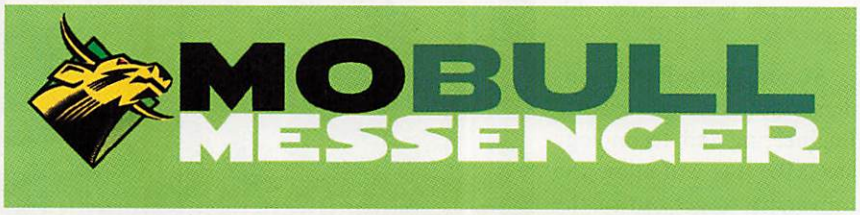
Called MoBull—the USF mascot is the bull—the wireless notification service uses Air2Web's wireless platform to deliver a variety of messages, including campus announcements (i.e., registration deadlines and club activities) and commercial messages, for which local vendors pay a per-message fee. For instance, a local pizza parlor, on a slow night, might buy advertising on MoBull, sending out a discount coupon. The targeted advertising has appeal for local businesses because it is relatively inexpensive and highly specific in its audience. Campus clubs and organizations are also interested in using the service to get announcements to members and potential members.

USF began rolling out the program in spring, 2002, but this fall will launch the program in earnest. Students can sign up for MoBull online, filling out a profile that helps fine-tune the messages they will receive. Vendors likewise can go online to order messages. The system calculates the likely cost of a message before the vendor purchases it. Costs are on a per-message basis, and buyers have options in terms of targeting particular groups.

"It gets pretty fine-grained," says Ellis. "For instance, a store selling men's clothing could send messages only to male students. We also can target receivers by zip code. Given how spread out our campus constituents are in the area, it makes sense for vendors to reach people who are nearby."

By summer of 2002, fewer than 1,000 students had enrolled. However, Akin and Ellis expect enrollment to increase exponentially as word gets out about the service, which is free for students. Akin notes that there are several events scheduled to promote the service this fall. Campus organizations are also using the service more frequently to notify students about financial aid and tuition deadlines, special events, and other announcements. The immediate nature of text messaging is making it a standard information access point for students with wireless devices. Plus, he says, "We've partnered with a local wireless vendor to offer cell phones to students who don't currently have them, so that they too can get MoBull service."

It's important to note that MoBull is also available to students via their e-mail accounts; having a wireless device is not mandatory. However, given how much more frequently students check a cell phone's instant text messaging versus e-mail, students are more likely to respond to messages received over the wireless device.



The IT department came up with a plan to link students to on- and off-campus services in a way that is potentially profitable for the university as well.

Says Ellis: "We're at a bit of a chicken and egg point right now. Local businesses would like to see a larger base of message receivers, and the students would like to see more deals in the form of messages. We expect this fall that the number of students enrolling in the program will increase considerably, and along with that, our list of advertisers."

Despite the relatively low number of subscribers over the spring and summer, Ellis says vendors were pleased. "They were seeing response rates from 4 to 10 percent," he says, noting that this is a much higher response rate than they would get from other—more expensive—forms of advertising.

The messenger application Ellis and Akin have created is available for licensing to other schools that may want to use it. For more information, visit www.mobull.usf.edu, or contact Chris Akin at ***cakin@admin.usf.edu,*** *or George Ellis at* ***gellis@admin.usf.edu.***

Michigan Community Colleges

Colleges Coalesce Around eLearning Platform

A group of Michigan community colleges has launched a major initiative focusing on learner-centered outcomes and standards, with the help of WIDS software, training, and design models. WIDS, or Worldwide Instructional Design System, is a set of software and training tools developed by the Wisconsin Technical College System. It is an approach to teaching, assessment, and outcomes measurement that is now in place in 300 schools and school systems in the United States and abroad.

Michigan's Department of Career Development partnered with WIDS last year to support curriculum development and advance a competency-based curriculum. Says Jim Folkening, director of the department's Office of Postsecondary Services: "Michigan community colleges have always had a commitment to academic quality. Recently, though, because of initiatives such as (Academic Quality Improvement Project) and others, we've begun offering incentives to the various campuses to implement specific programs. Academic improvement is the goal. WIDS is the technological platform many of the schools are using to reach it."

The software, now in its seventh version, allows educators to build courses online or offline, and produce outcome summaries, reports, syllabi, teaching plans, and performance assessment reports. The new software is faster, more functional, and more Web-friendly than its predecessors. Users can now generate work directly to HTML, for instance. The software features wizards that simplify document creation. It also allows more experienced users to forego the wizards in favor of customized output.

WIDS has been implemented by 26 of Michigan's 28 community colleges. Since the adoption of the statewide contract, over 300 instructors have completed the basic WIDS training. Many have gone on to create learner-centered courses and programs using the WIDS model. The community college system now has 50 coach trainers who will work as assistant trainers teaching new faculty initiates. Folkening notes that there is interest in WIDS across the board. "Enthusiasm for WIDS depends on the personality of the instructor," he says, not on the discipline from which he or she comes.

The software, faster and more Web-friendly that its predecessors, allows educators to build courses online or offline, and produce outcome summaries, reports, syllabi, teaching plans, and performance assessment reports.

Distance learning is a major application of WIDS. The ability to take documents directly into HTML and WIDS' compatibility with Blackboard, the platform in place at Michigan community colleges, makes it a natural choice for developing online courses. At Muskegon Community College, for instance, faculty are building distance learning courses from scratch using WIDS.

Although the implementation of WIDS statewide is relatively new, some Michigan schools had individual WIDS licenses long before the state contract was put into place. Mott Community College, for instance, has worked with WIDS for seven years. Over 100 of its instructors have completed basic WIDS training. Seven Mott faculty members have completed trainer-level preparation and now work with onsite faculty who need support implementing WIDS techniques. At Mott, WIDS is used for any course that is modularized—that is, any course that is developed in components—as well as many standard courses.

According to Lynn Thigpen, an instructor in Mott's Communications Technology program, WIDS has been a great boon to their campus. "Mott has always been a leader in providing distance education, first via videotape and now via both videotape and some online courses," says Thigpen. "WIDS has given us a better instructional design model for distance education courses."

Thigpen believes that WIDS has given teachers a better tool for working with student performance. "It helps instructors work with students to solve problems," she says. Also, from a faculty development standpoint, WIDS has made a significant contribution by getting all faculty members on the same page, pedagogically and structurally. "Using the same system gets everyone talking a common language."

Folkening expects the focus on outcomes to continue, with WIDS being part of the picture. Their three-year contract is designed to give the community colleges time to train plenty of coach trainers who will then carry on the WIDS mission. At the moment there is no shortage of interest among faculty who want to learn the WIDS system. "Success breeds success," says Folkening.

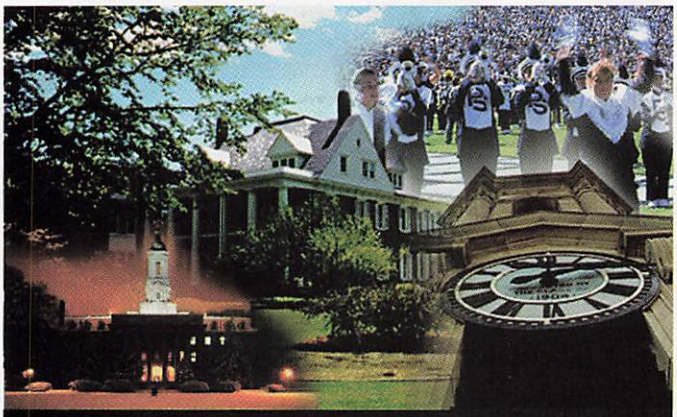
*For more information visit www.wids.org or contact Robin Soine, WIDS, at (800) 821-6313 or **soiner@wids.org**.*

Pennsylvania State University

Imaging at Penn State: One Solution, Multiple Variations

Penn State University is a big school, as big as they come. From undergraduate to post-doctoral programs, the university serves almost 80,000 students on 24 campuses. As such, it has all the needs of any business, and has human resources, accounts payable, and enterprise resource planning systems. In addition, it documents the administrative path of all its students, from first admission through alumni gift-giving.

Thus the number of student-related records far exceeds 80,000 as it includes applicants who do not ultimately attend the school as well as all 400,000 living alumni. Not surprisingly, documents—primarily paper—are the fabric of the institution. Document storage runs into the billions of pages.



"Once you have a vision, you have to sell it to users. If people don't buy in, it's constant sorrow."

In the mid-1990s, that became overwhelming. Increasingly, paper was stored off site. The time and cost of mailing or faxing documents to campuses across the state exasperated the staff and sapped funds from important projects. In 1994, Penn State formed a university-wide Imaging Committee to evaluate the ability of document technologies to meet its needs. The resulting report, available at www.psu.edu/computing/imaging.html, noted several advantages that document imaging technologies could provide, including simultaneous access to centralized records; elimination of expensive recordkeeping redundancies; limiting labor costs; and improved documentation of research and archiving of visual materials.

In late 1996, the Committee began to request proposals for an imaging system, and ultimately chose a system from Optical Imaging Technology (OIT). "It had a lot to do with features, functionality, and their good track record," said Edie Hertzog, associate director of Penn State Information Resources. "Looking at their demo and what they offered, it was easy to see a vision that would bring us a long way."

OIT installed a prototype system at the Finance and Business offices. When that solution proved successful, Penn State bought an unlimited enterprise license from OIT. Soon after, the accounting, police, and human resources departments began to install the system, followed by physical plant and the office of administrative systems. By early 2002, 13 departments used OIT software. "Now we have imaging and COLD [Computer Output to Laser Disk] implemented across the university system, and we have plans for additional installations," said Hertzog.

As with most campus-wide conversions, some departments resisted the change. The Imaging Committee and OIT realized that the implementation process and training were as important as the software itself. "Although it is easy to use, the software has so much functionality that you can't easily comprehend it," said Hertzog. "Once you have a vision, you have to sell it to users. You try to do something really good, but if people who use it don't buy in, it is a constant sorrow. The places where this has been most successful are the places that have created the correct interface between images and their work.

Recognizing their interdependence, Penn State and OIT created an active user group. Within the user group, OIT can hear the needs of the users, and subsequently work to improve both the software's functionality and its delivery. "It is an evolving product, and we are a part of the development process," Hertzog notes.

Accounting

Accounting is one of the largest departments within

the Corporate Controller's Office, which oversees the university's finances and was the initial point of installation for OIT products at Penn State. The office also includes Payroll, Risk Management, Financial Reporting, and Research Accounting. The latter monitors the grants and expenditures related to all of the academic research at Penn State.

When Accounting was paper-based, most of the several million records were stored away from the office site. Both retrieval and re-filing were labor intensive. Operators who now scan between 3,000 to 5,000 pages per day—in addition to credit card receipts and statements—replaced the old retrieval process in 1997. Now the most recent records reside in a RAID storage system for near instant retrieval. As records age, they migrate to an optical disk jukebox where retrievals may take a few seconds.

Nearly all of Accounting's records are now digital, and the rest will follow shortly. Workers with security clearance view the images (primarily accounts payable documents) using a Web browser.

Law Enforcement

For the University Police Department, the issue is not the overload of paper as much as accessibility and "share-ability" of records. Bruce Kline, a 30-year veteran of the Penn State Police and Assistant Director for Administrative Systems, oversees the documentation of about 3,300 cases per year. "Most take from three to 10 pages, but in 1997 we had a shooting that generated thousands of pages."

The bigger challenge is sharing information regionally. University Police interact with six different city police departments, the Borough of State College that administers two townships, and two other townships with their own P.D.s. Those offices and the regional 911 center exchange information on a regional intranet. The University Police staff of 65 views any of the departments' 2.5 million pages almost instantly. Although not yet implemented, they have the potential to fully share their files with any agency they choose via conventional browsers.

Undergraduate Admissions

The Undergraduate Admissions Office was ripe for remote access because of its structure. The Office processes applications for admission to all undergraduate programs at 20 campuses. Now Web access to student applications and supporting documents replaces a tremendous amount of manual filing, shuffling, and a flurry of faxes and phone calls. Remote workers simply log in and call up any records they need to see.

Penn State receives about 50,000 undergraduate applications a year. This is complicated by the fact that it is a seasonal load, with most arriving in the fall, and that supporting documents often arrive independently and sporadically and need to be associated with particular applications. The solution is that each paper application receives its own bar code when it arrives. When supporting documents arrive, the mainframe database finds the applicant by name, social security number, or other identifiers, and assigns the application's barcode to the new arrivals.

The 2001-2002 admissions year was the first time that almost half of the applications arrived over the Web. Those applications go to the mainframe system directly. They become entries in computer reports that are available to browsers with no significant difference from the scanned paper applications. Because the mainframe is fully integrated with the OIT system, changes made in the database automatically appear in the document system.

Hertzog points to the integration of OIT software with existing platforms, systems and databases as one reason for the multiple successes at the university. Penn State is now building its own portal system, and has asked OIT to integrate the document technologies with the portal application.

For more information on Penn State's imaging technology project, visit ***http://ais.psu.edu/edocuments.***

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Bluesocket Wireless Gateways: Roles-Based Network Rules

When the subject of security comes up, the buzz in wireless networking circles is often tempered. In fact, one reason that all universities have not jumped wholeheartedly into the wireless world is that wireless transmissions have so many unique security issues. Intrepid students may install their own access points in order to connect their own wireless hardware. Hacking into confidential files is a risk. Bandwidth hogging is a factor as well; institutions have to ensure that students with their MP3 habits don't gobble up bandwidth. Much secure networking, including virtual private networks and so-called secure roaming solutions, require that software be installed on every mobile device accessing the network. So, given that campus users are using everything from PDAs to laptop PCs to iBooks, it would be difficult to imagine any school IT team covering all the bases.

The problem is solvable, however. One solution is the wireless gateway from Bluesocket Inc. The company makes three products: a product designed for small offices (up to 15 people) and two enterprise-level gateways. The Bluesocket WG-1000 wireless gateway is appropriate for most higher education institutions. The company points out that it has more than four dozen higher education customers across the educational landscape, including liberal arts colleges, large state universities, medical schools, and community colleges. The company recognizes the value of the education market and courts it with enthusiasm.

So how does a wireless gateway work? A gateway acts like a security guard or a bouncer. Based on the user's password, it evaluates who is attempting to access the wireless LAN and how they intend to use it. The gateway, relying on assigned roles and other instructions, permits or denies entry to the network. There is no need for client-side software; the browser-based gateway will do the job regardless of what type of wireless device the user has. Bluesocket's gateway is also entirely agnostic to the type of access point or standard (WiFi or WiFi5) being used. It simply addresses traffic as it arrives. The roles-based management system lets administrators control what someone can access, when they can access it, and how much bandwidth they can use. So, high-bandwidth users (for instance a researcher using a lot of medical imaging technology) would be assigned more bandwidth than a student.

Bluesocket promises privacy on the wireless LAN. Using its gateway, institutions can terminate a VPN tunnel before it enters the secured network. This packet-level filtering supports a wide array of privacy and authentication schemes, including IPSec, 802.1x, other 802.11 extensions, PPTP, SSL, and others. The vendor agnostic software provides single points of entry and authentication for all members of the campus community.

Wireless done right can increase access to campus services and the Internet, powering a completely location-free educational experience. It may also offer some cost savings, although that hasn't been proven in large installations. On a small-to-medium scale, especially where the campus has other barriers to wiring a network (historically important architecture, for instance), it may prove financially beneficial. A survey conducted by Buena Vista University concluded that the cost of wiring several dozen classrooms was five times the cost of setting up a wireless network. Wireless also connects faster than dial-up. In any case, it's clearly imperative that the wireless LAN not put an undue burden on network administrators. Bluesocket's gateway may be an important part of the solution.

For more information about Bluesocket, visit ***www.bluesocket.com*** *or call (781) 328-0888 or (866) 633-3358.*

Apple Remote Desktop: Management Tool Plus Teaching Assistant

By John Kinsella,
University of St. Thomas

Choosing Mac OS X this summer as our default operating system for new computers was a relatively easy choice for my institution. The benefits—stability, ease-of-use, security, and interoperability—all far outweighed the complication it presented. A sticking point for us was our regular use of Apple Network Assistant (ANA) for remotely assisting our clients and managing our labs; we needed a MacOS X equivalent. With the release of Apple Remote Desktop (ARD) in February 2002, Apple addressed that need.

The beauty of ARD is its simplicity and the features it provides faculty for use in the classroom. For instance, in the absence of a good projection system, ARD allows a professor to demonstrate a skill or lecture by sharing her computer screen with all of the other computers in the classroom. A professor or lab attendant can also view up to four screens at once on their computer screen, or they could cycle through all of the computers in the room—4 screens at a time—in order to keep tabs on student progress. There are also real-time chat features that allow individual faculty and students to hold private discussions, allow a student to "raise a hand," or allow a professor to send out classroom alerts, such as an approaching time limit on an exam.

To ensure students' attention, a professor also has the ability to monitor computer use in the class or to lock out access to students' computers during a lecture or presentation. And for the easy distribution of class material, a professor could send out materials to all of the computers at once. These same tools can also allow administrators to remotely assist client machines, perform upgrades, and even run software and hardware reports.

In my experience, ARD has worked exactly as I have expected. It is obvious that this initial release was aimed at bringing tools that were available under OS 9 to OS X. In managing my labs and client computers, I have found that screen sharing, file distribution, and remote application launching are the most valuable tools. It is much more efficient for me to share or control a client's computer in order to work on a problem than it is to walk to each client machine to do the same work. Also, the fact that ARD is available in both MacOS X and MacOS 9-8.1 versions allows us to manage multiple Mac operating systems from the same workstation. (As an aside, one reason I've become excited about ARD is that with some custom AppleScripts I have developed, I can remotely launch one AppleScript that will send off a series of events to erase files on a lab computer or computers, and reinstall all of the necessary system and application software, all from my office computer.)

Upgrading to ARD is painless. You can install it over the current installation of ANA and it will pick up the current settings, passwords, and information fields automatically.

Although ARD provides the same basic functionality that ANA provided, there are a few useful features missing. For instance, some of the workstation configuration features are gone. Unlike ANA, you do not have the ability to change the ARD administrator's password on the client machines, nor can you set the Energy Saver, Screen Resolution, or Date & Time settings. These features are useful when setting up a lab, in that they allow much of the setup to be handled en mass rather than setting up each workstation individually.

Also, currently missing from ARD as well as ANA is a robust software installation tool. The file copy features work well for what they do, but don't allow for the installation of software, or an operating system, which have different pieces going to different places on the local hard drive or which require administrator access (in OS X.). In order to install a piece of software like this, the support staff would have to figure out which files needed to be placed where, and to transfer those files individually to the client computers. This still saves time on the installation process, but it is tedious and hopefully can be addressed in the future.

Finally it would be nice to see ARD combined with other Apple software to provide simple workstation re-imaging that can be done automatically and remotely, rather than having to develop our own solution, as I did.

ARD is an enabling technology from Apple. It provides helpful tools that give faculty many choices in incorporating technology into their course. Those same tools can then be used by IT or help desk staff to improve efficiency and reduce costs. And it is one of the last tools many people have been waiting for before making the transition to MacOS X.

John Kinsella is Academic Technology Support Specialist for the University of St. Thomas in St. Paul, Minn. He can be reached at ***jrkinsella@stthomas.edu.***

TECHNOLOGY ROUND-UP

Dual Access Points for Wireless Networking

As the popularity of wireless LANs (WLANs) increases, access points, those little boxes that connect the wired world to wireless devices, are popping up all over campus. Access points are what keep WLAN clients connected as they roam about a facility. But choosing the right hardware from among the wide array of vendors and product lines can be challenging. To complicate matters further, a new higher-speed wireless standard, 802.11a (or WiFi5), is now available, and an even newer one (802.11g) is coming. Network managers have to choose to comply with the old 802.11b (WiFi) standard, which supports users at up to 11Mbps, or the new WiFi5, which offers support for high-bandwidth applications like streaming video. Or they can put in dual access points, which comply with both standards, while simultaneously planning for the next wave. Because dual access points seem to offer a solution to this problem, we've decided to profile the major vendors.

Intel Pro/ Wireless 5000

Cisco Aironet 1200 Series

Cisco promises secure and reliable management of the current WLAN configuration while setting the stage for a smooth migration to WiFi5. The modular design of the Cisco Aironet 1200 Series allows for both single- and dual-band configuration, plus field upgradability to modify these configurations as user requirements change and the technology evolves. The product can accommodate one radio for WiFi and another radio for high-speed WiFi5 clients. In other words, it's possible to use the slower standard for some purposes and the higher standard for others, without having to purchase two types of access points. Instead, users would purchase the additional radio module as bandwidth needs grow. Extra memory is there to support further upgrades down the line. Cisco secures the connection with its Wireless Security Suite, which is based on the IEEE 802.1X standard and its Extensible Authentication Protocol (EAP). The company promises reliability through its time-tested fourth-generation radio and its redundant hot-standby backup access point. A rugged case and mounting and locking features are designed for durability and theft resistance. Contact: Cisco, www.cisco.com

Cisco Aironet 1200

Intel Pro/Wireless 5000

Named a 2002 product of the year by Networking magazine, the Intel Pro/-Wireless 5000 LAN Dual Access Point promises to deliver reliable connectivity for high bandwidth applications. Full IEEE 802.11a and 802.11b compliance simultaneously supports wireless LAN users at up to 54 Mbps and up to 11 Mbps. With the product, organizations can preserve their investments in WiFi technology while simultaneously migrating over to WiFi5. As with the Cisco system, organizations can add WiFi5 modules as needed. Eight non-overlapping channels and three for WiFi provide access for more users, with up to 432 Mbps network capacity in a particular area. The product comes with a software-configurable antenna and site survey tools to facilitate placement and configuration. The device can be mounted or placed on a table. Contact Intel, Santa Clara, Calif; (800) 538-3373; www.intel.com/network/connectivity.

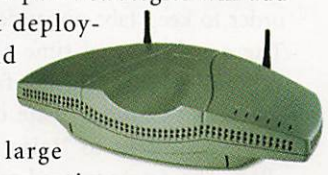
Proxim Harmony Series

The multi-standard access point product, which offered the first 802.11a products available, won the Network World Editor's Choice Award, primarily because it offered greater WiFi5 roaming range than most of its competition. Proxim also claims to have the industry's fastest wireless LAN, with a WiFi5 speed of 108 Mbps, facilitating conference room collaboration, classroom networking, and hot spots. Additionally, 802.11a (WiFi5) has 8 channels to support more users and higher bandwidth applications. The product is designed to accommodate WiFi, WiFi5, and the future 802.11g standard. As with the other dual access points profiled here, users simply add modules to comply with the new standards. The centralized configuration, security, and management setup lower costs of ownership. The Harmony solution also offers the highest level of security available with support for 802.1x. Contact: Proxim Corporation, Sunnyvale, Calif.; (800) 229-1630; www.proxim.com.

Proxim Harmony access point

Symbol Technologies

The company does not market dual mode access points, believing that dual-mode access point strategies will add significant deployment and maintenance costs to large deployments over time. However, the company offers two cost effective strategies for co-adopting 802.11a with 802.11b. Existing Symbol customers looking to immediately adopt 802.11a should consider the Mobius 5224 Access Point, which is designed to snap onto already installed Spectrum24 frequency hopping and Spectrum24 High Rate



Mobius 5224 Access Point

Wi-Fi access points to instantly create dual-mode wireless access. For customers looking for a single system to manage multiple standard-based wireless networks, Symbol offers the Mobius Axon Wireless System, the first wireless networking switch and access port system designed to deliver and manage IEEE 802.11b, 802.11a, 802.11g, and Bluetooth wireless technologies. Delivering wireless through Mobius Axon Access Ports, the Mobius Axon Wireless Switch houses all the network management, security, network services, and other intelligence of high performance, standard-based wireless networking into a scalable system that resides at the core of the network. Symbol says the new system delivers a much lower total cost of ownership when compared to deploying and maintaining enterprise-class, intelligent 802.11b and 802.11a dual-mode WLAN access points. Contact: Symbol Technologies, Holtsville, N.Y.; 800.722.6234; www.symbol.com.

D-Link AirPro

DWL-6000AP

The DWL-6000AP Wireless Network 2.4GHz/5GHz Multimode wireless access point offers 11 non-overlapping channels, boasting transfer rates of up to 72Mbps with D-Link AirPro adapters in the 5GHz frequency range and 22Mbps with D-Link AirPlus adapters in the 2.4GHz frequency range. Up to eight units can be installed in any location. In addition to bridging 802.11a and 802.11b wireless networks, the D-Link AirPro DWL-6000AP can bridge to wired networks with its integrated 10/100 Ethernet port. The DWL-6000AP supports user-selectable encryption settings, up to 152-bit WEP on the 5GHz band and up to 256-bit WEP on the 2.4GHz band. Contact: D-Link, Irvine, Calif; (800) 326-1688; www.dlink.com.

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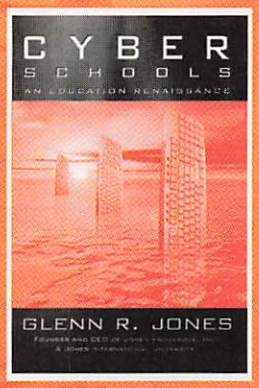

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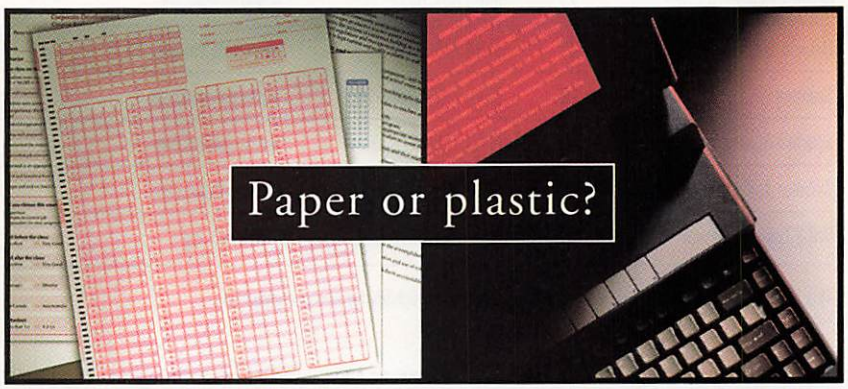

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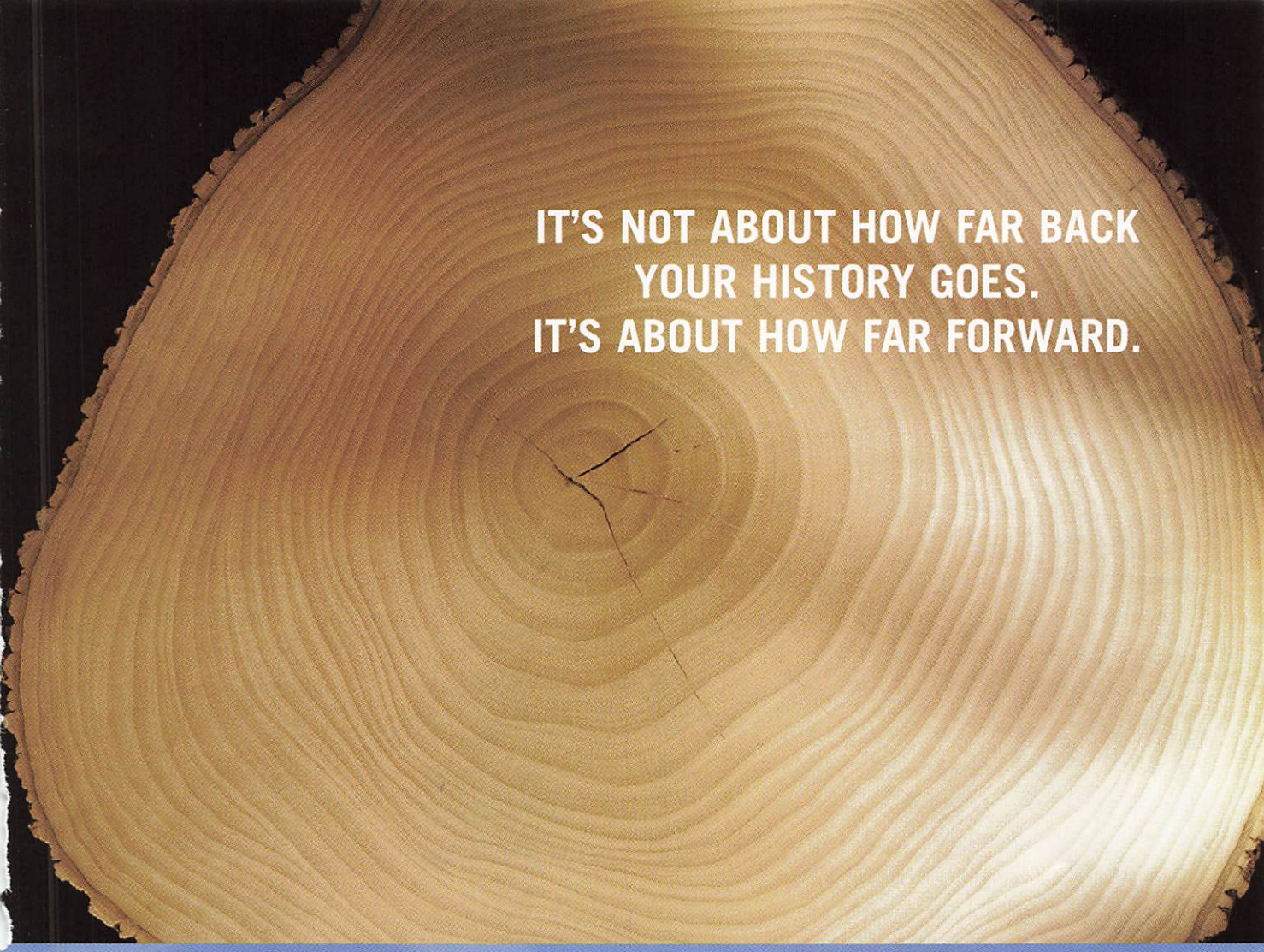

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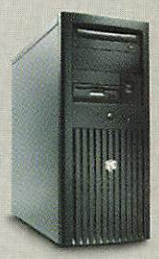

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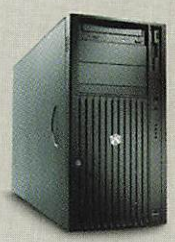

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